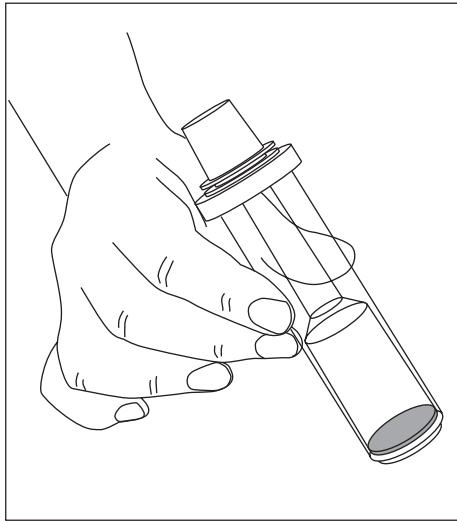


CENTRIPREP®

Centrifugal Filter Devices

User Guide



- Centriprep centrifugal filter devices with Ultracel® YM membranes, 10,000 and 30,000 NMWL, are approved for in vitro diagnostic use
- Centriprep centrifugal filter devices with Ultracel YM membranes, 3,000 and 50,000 NMWL, are for research use only and are not for use in diagnostic procedures.

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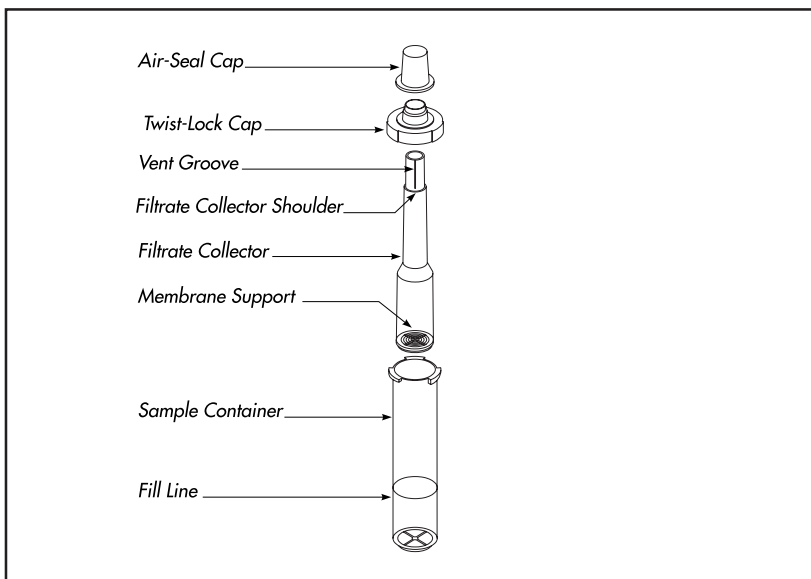
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Introduction

Centriprep centrifugal filter devices are disposable ultrafiltration devices used for purifying, concentrating, and desalting biological samples in the 2–15 mL volume range. They may also be used for filtration applications. These complete, ready-to-use ultrafiltration devices are designed for operation in most centrifuges that can accommodate 50 mL centrifuge tubes. They are easy to use and offer a high flow rate. Centriprep devices consist of a sample container with a twist-lock cap, a filtrate collector containing a low adsorptive Ultracel YM regenerated cellulose membrane, plus an air-seal cap for sample isolation.

The Centriprep device's design allows filtration to occur at the same time that fine particles are sedimenting, without clogging the membrane. For example, using the Centriprep device with Ultracel YM-50 (50,000 NMWL) membrane, a 15 mL sample can be concentrated to 0.7 mL in just 20 minutes. The concentration of smaller volumes takes less time. Because of the membrane's low adsorptivity, high concentration factors are achieved. Greater than 90% recovery of retained macromolecular solutes is typical. In order to prevent filtration to complete dryness, a built-in deadstop provides a final concentrated sample volume of 0.6–0.7 mL.

Centriprep Centrifugal Filter Device Components



Nominal Molecular Weight Limits

The Centriprep product line currently includes devices with:

- Ultracel YM-3 membrane — 3,000 Nominal Molecular Weight Limit (NMWL)
- Ultracel YM-10 membrane — 10,000 NMWL
- Ultracel YM-30 membrane — 30,000 NMWL
- Ultracel YM-50 membrane — 50,000 NMWL

Intended Use

▲WARNING: Centriprep devices containing Ultracel YM-10 and Ultracel YM-30 membranes are for in vitro diagnostic use. Centriprep devices containing Ultracel YM-3 and Ultracel YM-50 membranes are for research use only, NOT for use in diagnostic procedures.

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For in vitro diagnostic use



For research use only

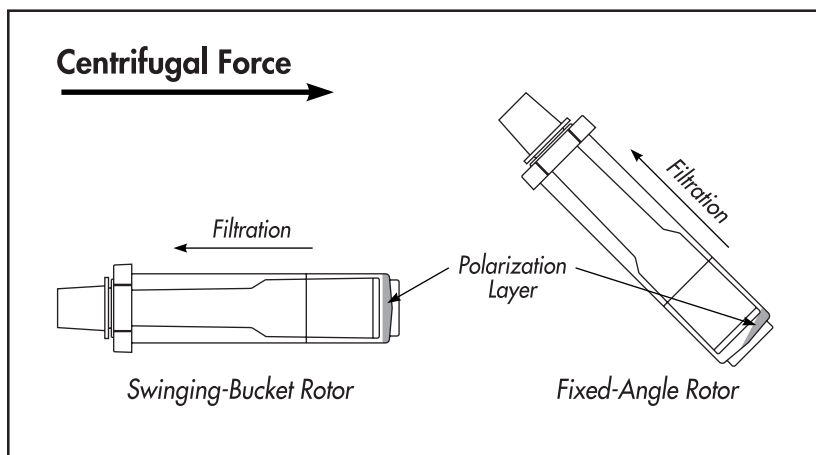
Examples of Research Applications: Centriprep centrifugal filter devices with Ultracel YM-3 membrane can be used to concentrate and desalt oligonucleotides, peptides, growth factors, and small proteins. Applications for the Centriprep devices with Ultracel YM-10, Ultracel YM-30, and Ultracel YM-50 membranes include concentrating and desalting column eluates and gradient fractions containing proteins, enzymes, and antibodies; recovering biomolecules from cell culture supernatants, lysates, extracts, or other biological samples; purifying low-molecular-weight components (e.g., amino acids and antibiotics) from physiological fluids, cell culture media, or fermentation broths.

In vitro Diagnostic Use: The Centriprep centrifugal filter devices with Ultracel YM-10 and Ultracel YM-30 membranes use ultrafiltration to concentrate macromolecules in serum, urine, cerebrospinal fluid and other body fluids before these fluids are analyzed. All other Centriprep centrifugal filter devices are for research use only, not for use in diagnostic procedures.

Product Advantages

With biological samples, Centriprep centrifugal filter devices offer many advantages over such concentration techniques as chemical precipitation, evaporation, lyophilization and dialysis. For example, setup time with the Centriprep device is minimal. The device is simply spun until the desired concentration is achieved. Also, the filtration process itself is gentle, avoiding potential problems such as sample denaturation and concentration of buffer salts. Since concentration and desalting occur simultaneously within the Centriprep device, sample losses due to material transfer are eliminated. The design is ideal for solutions containing fine particulate material because filtration occurs in the opposite direction from sedimentation, which reduces membrane clogging. The Centriprep centrifugal filter device's all-in-one design also provides added safety when working with hazardous samples. Because all materials are contained within the device, operator exposure to biohazards is minimized.

Polarization Control



Equipment Required

Centriprep devices can be spun in a variable speed centrifuge with either a swinging-bucket or fixed-angle rotor and carrier that can properly accommodate 50 mL centrifuge tubes. The centrifuge must be capable of 500–3000 \times g. For a listing of compatible centrifuges and rotors, see www.millipore.com/rotorguide.

Limitations

With fixed-angle rotors, polarization control may be adversely affected at low g-forces (below 2000 \times g). Depending on sample composition and solute concentration, filtrate flow may be reduced. When using either type of centrifuge, do not exceed the following limits because excessive g-force may result in leakage or damage to the device.

Maximum Centrifugal Force

Centriprep filter devices with:

Ultracel YM-3 and Ultracel YM-10 membranes: 3000 \times g

Ultracel YM-30 and Ultracel YM-50 membranes: 1500 \times g

Chemical Compatibilities

Centriprep centrifugal filter devices are intended for use with biological fluids or aqueous macromolecular solutions. Before use, check the sample for chemical compatibility with the device. The solutions listed in the following chart have been evaluated for chemical compatibility with Centriprep membranes and component parts.

Chemical Compatibility by Model

Common Acids/Alkalis	3K, 10K, 30K, 50K NMWL
Acetic acid (80%)	✓
Ammonium hydroxide (10%)	✗
Formic acid (50%)	✓
Hydrochloric acid (1.0 N)	✓
Lactic acid (50%)	✓
Nitric acid (10%)	?
Phosphoric acid (10%)	✓
Phosphoric acid (30%)	✓
Sodium hydroxide (0.1 N)	?
Sulfuric acid (3%)	✓
Sulfuric acid (30%)	✗
Trichloroacetic acid (10%)	?
Trifluoroacetic acid (30%)	✓
Trifluoroacetic acid (50%)	✓
Organic Solvents/Miscellaneous	3K, 10K, 30K, 50K NMWL
Acetone	✗
Acetonitrile (20%)	✓
Acetonitrile (30%)	✓
Alconox® (1%)	✓
Ammonium sulfate (saturated)	✓
Benzene	✗
n-Butanol (90%)	✓
Carbon tetrachloride	✗
Chloroform	✗
Diethyl pyrocarbonate (0.2%)	✓
Dimethyl sulfoxide (5%)	✓
Dimethyl formamide (50%)	✓
Dioxane (50%)	✗
Dithiothreitol (0.1 M)	✓
Ethanol (20%)	✓
Ethanol (70%)	✓
Ethyl acetate	✗
Formaldehyde (5%)	✓
Glycerin	✓
Guanidine HCl (6 M)	✓

Legend: ✓ = Acceptable ? = Questionable ✗ = Not Recommended

Chemical Compatibility by Model, continued

Organic Solvents/Miscellaneous	3K, 10K, 30K, 50K NMWL
Guanidine thiocyanate (0.5 M)	✓
Guanidine thiocyanate (5.0 M)	✗
Imidazole (0.1 M)	✓
Lubrol® PX emulsifier (0.1%)	✓
Mercaptoethanol (0.1 M)	?
Methanol (20%)	✓
Methanol (60%)	✓
Methanol (70%)	?
Nonidet™ P-40 surfactant (2%)	✓
Phenol (1%)	✓
Phosphate buffer (1 M, pH 8.2)	✓
Polyethylene glycol (10%)	✓
Polyethylene glycol	✓
Propanol (20%)	✓
Propanol (70%)	✓
PyroCLEAN™ buffer	✓
Pyridine	✗
Sodium carbonate (20%)	✓
Sodium deoxycholate (5%)	✓
Sodium dodecyl sulfate (2%)	✓
Sodium thiocyanate (3 M)	✓
Terg-A-Zyme® detergent (1%)	✓
Tetrahydrofuran	✗
Toluene	✗
Tris buffer (1 M, pH 8.2)	✓
Triton® X-100 surfactant (0.002 M)	✓
Tween®-20 surfactant (0.1%)	✓
Urea (8 M)	✓

Legend: ✓ = Acceptable ? = Questionable ✗ = Not Recommended

Prerinsing

The membranes in Centriprep centrifugal filter devices contain trace amounts of glycerin. If this interferes with analysis, rinse devices until no more interference is noted. Centrifuge approximately 15 mL of buffer or deionized water until the first equilibration point is reached. Decant filtrate and retentate (repeat rinsing if necessary), then begin operation with the sample solution. Once wet, membranes must be kept wet to remain functional.

Membrane and Device Appearance

- Occasionally, an unused Centriprep device may have a few drops of moisture in the filtrate collector or sample container. This is due to condensation of moisture in the membrane and does not affect performance.
- After centrifugation, a small amount of filtrate (approximately 0.5 mL) may remain in the area between the membrane and the membrane support of all Centriprep models. This is normal and does not affect device operation or performance.
- The Ultracel YM membrane used in the Centriprep centrifugal filter devices normally swells upon first contact with aqueous solutions. After centrifugation, these membranes may therefore appear to be slightly swollen.
- Membranes that contain glycerin can normally appear in a range from translucent to opaque white.

Centrifugal Filter Device Reuse

Centriprep devices are intended for single use only. Attempts to clean the device could damage the membrane surface or its seal, possibly compromising the unit's integrity and thereby affecting performance. For this reason, Millipore recommends disposing of Centriprep centrifugal filter devices immediately after use.

Principle of Operation

To begin operation, the sample container's twist-lock cap is loosened and the filtrate collector is removed. Sample is added, then the filtrate collector is carefully reinserted back into the sample container (displacing solution) and the cap locked, sealing the device. The assembled centrifugal filter device is centrifuged at $1000\text{--}3000 \times g$, depending on model used.

Immersing the filtrate collector in the sample solution creates a slight hydrostatic pressure differential that exerts an upward buoyancy force on the membrane at the filtrate collector bottom. By itself, the hydrostatic pressure exerted by the displaced solution is too weak to produce ultrafiltration. Centrifugation increases this pressure, forcing low molecular weight materials and solvent through the membrane into the filtrate collector. Solutes with molecular weights above the membrane cut-off remain in the sample container (retentate) and become increasingly concentrated as the operation continues. Ultrafiltration occurs in the direction opposite the centrifugal force vector.

The pressure differential created by the raised solution level is important in centrifugal filter device operation. During centrifugation, the sample solution meniscus falls as the filtrate meniscus rises. In the process, the filtrate collector loses its buoyancy and sinks to the bottom of the sample container, permitting maximum filtrate collection. Eventually, an equilibrium is reached where the menisci reach equal height. Filtration then stops, since the hydrostatic pressure difference is now zero.

If further concentration is required, decant the filtrate before spinning the device for a second time. Decanting re-establishes the pressure differential between the sample meniscus and the filtrate meniscus, allowing filtration to resume. Filtration continues until a new equilibrium point is achieved. Note that the pressure differential is constantly changing during operation as the menisci rise and fall.

Centriprep centrifugal filter devices are designed to maintain high flow rates by minimizing solute build-up on the membrane during operation. Centrifugal force causes dense materials to sink away from the membrane to the sample container bottom. Because the Centriprep membrane "floats" above this polarization layer, the full surface of the membrane is used at all times, and filtrate flow is unrestricted. This is particularly beneficial when working with suspensions, which can easily clog or foul a membrane.

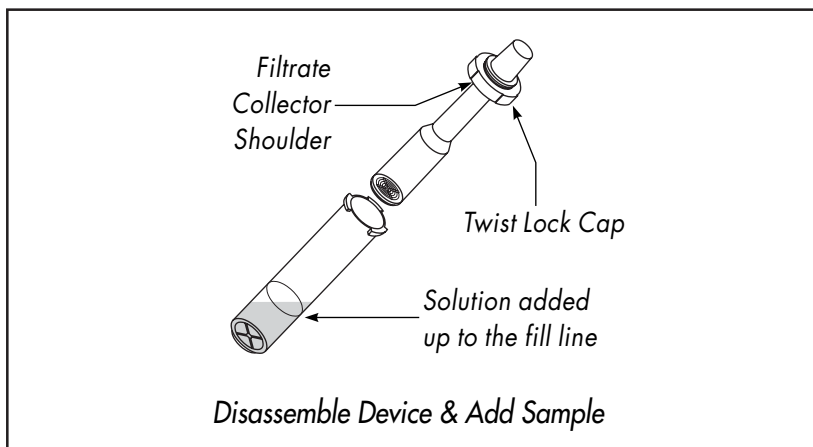
How to Use Centriprep Centrifugal Filter Devices

1. Turn twist-lock cap on sample container counterclockwise, but do not remove it completely. Then slide filtrate collector assembly out and set it aside.

CAUTION: While filling the sample container, the membrane surface (on bottom of filtrate collector) is exposed. When handling, be careful not to touch, scratch or damage the membrane.

2. Add solution to the sample container up to the fill line on side of container. The maximum volume is 15 mL.

NOTE: For solutions with particulate material, such as cell suspensions, a starting volume over 5 mL will result in reduced flow rates. For best results when working with a sample having over 10% solids, limit the initial sample volume to 5 mL or less.

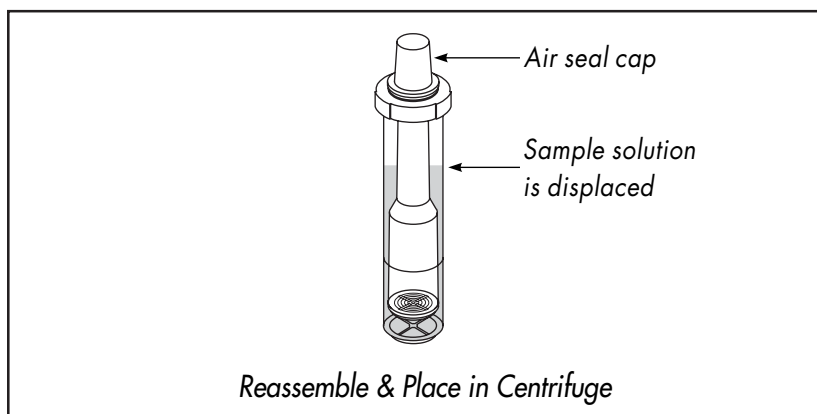


3. Make sure the twist-lock cap seats fully onto shoulder of filtrate collector. If necessary, slide cap downward until it stops at shoulder.
4. Carefully insert the capped filtrate collector into sample container, gently pushing down so collector displaces solution. Turn the twist-lock cap clockwise to seal the sample container. Finally, make sure air-seal cap is snug on twist-lock cap.

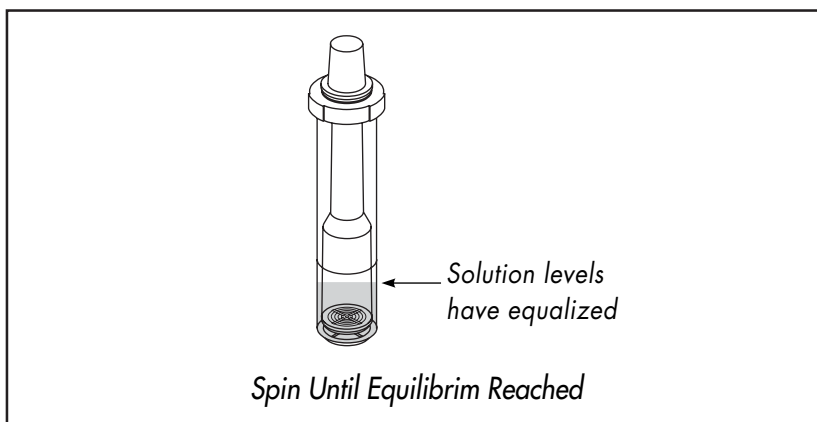
How to Use Centriprep Devices, continued

5. Insert the assembled Centriprep device into centrifuge and counterbalance with a similar device.

CAUTION: Inspect swinging-bucket rotors for proper clearance before centrifuging. Any obstruction may result in damage to the Centriprep device and possible loss of sample. For added clearance, the Centriprep device may be used in adaptors without rubber cushions.

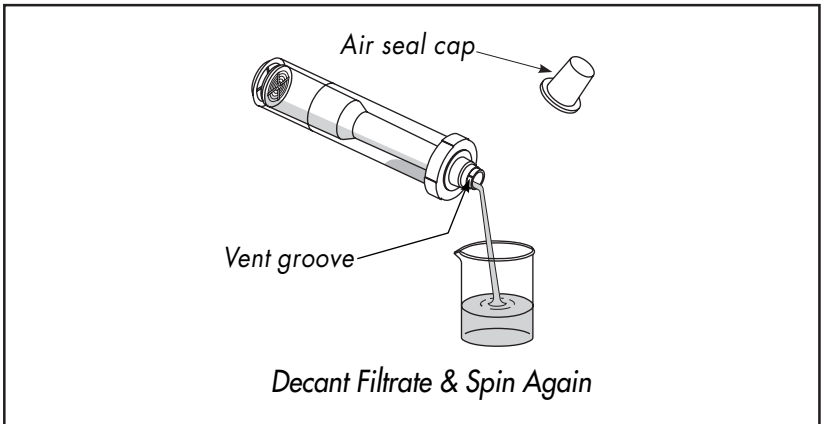


6. Spin the Centriprep device at the appropriate g-force until the fluid levels inside and outside the filtrate collector equilibrate. For concentration applications, see the guidelines for achieving various concentration volumes outlined in the following "Concentration Volumes for Dilute Protein Solutions" section.

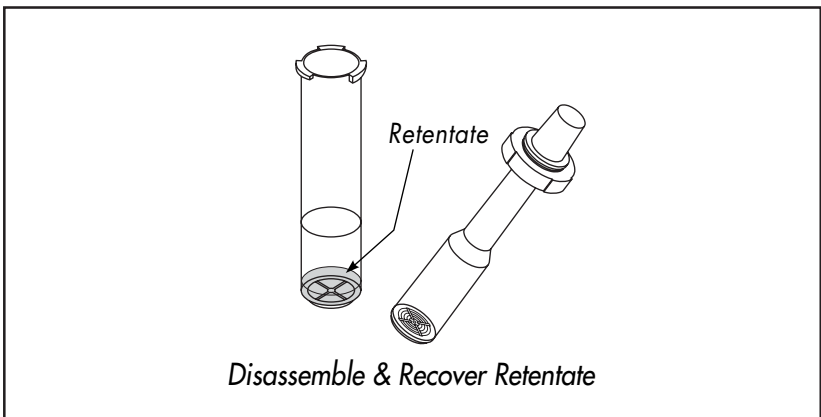


How to Use Centriprep Devices, continued

7. If further concentration is required after equilibration, remove the device from the centrifuge and snap off the air-seal cap. With vent groove oriented upward, decant the filtrate; replace cap and spin device a second time. For filtration applications, reserve the filtrate.



8. After second spin, decant the remaining filtrate. If further concentration is desired, spin device again; otherwise, proceed to step 9.
9. Loosen the twist-lock cap (turn counterclockwise) and remove filtrate collector. Withdraw the sample using a pipette, or pour the concentrate into a suitable container.



Concentration Volumes for Dilute Protein Solutions

Start Volume (mL) of Centriprep Device	Spin Time (min) and Retentate Volume (mL)							
	min		mL		min		mL	
3,000 NMWL	Spin #1		Spin #2		Spin #3			
5	50	1.00	10	0.65	10	0.60		
10	65	1.90	10	0.90	10	0.65		
15	95	3.00	35	0.90	10	0.65		
10,000 NMWL	Spin #1		Spin #2		Spin #3			
5	15	0.95	10	0.60	N/A			
10	30	1.70	10	0.70	5	0.60		
15	40	3.00	10	0.90	5	0.65		
30,000 NMWL	Spin #1		Spin #2		Spin #3			
5	5	1.10	5	0.65	5	0.60		
10	10	1.85	5	0.70	5	0.60		
15	15	3.00	10	0.85	5	0.65		
50,000 NMWL	Spin #1		Spin #2		Spin #3			
5	5	1.10	5	0.70	5	0.60		
10	10	1.75	5	0.80	5	0.60		
15	10	3.00	5	0.90	5	0.65		

Samples:

Centriprep device, 3,000 NMWL: Cytochrome c, 0.25 mg/mL

Centriprep devices, 10,000 NMWL, 30,000 NMWL, 50,000 NMWL: Bovine serum albumin, 1 mg/mL

Centriprep device g-forces:

3,000 NMWL, 10,000 NMWL: 3000 × g

30,000 NMWL, 50,000 NMWL: 1500 × g

swinging-bucket or fixed-angle rotor • temperature: 25 °C

N/A = not applicable; third spin unnecessary

Device Storage

For best results, store centrifugal filter devices at temperatures of 15–30 °C. Performance may be adversely affected if the devices are stored at extreme temperatures (i.e., below 0 °C or above 40 °C).

Performance

Flow rates and recovery characteristics of Centriprep centrifugal filter devices have been tested with several well-known solutes. These results, which are summarized in the following sections, may be used to estimate performance with other solutes.

Relative centrifugal force (RCF) is measured at the filtrate collector base and is calculated thus:

$$\text{RCF} = 1.118 \times 10^{-5} \times \text{radius} \times (\text{RPM})^2$$

Where radius = distance in centimeters, measured from the center of rotation to the base of the filtrate collector and

RPM = revolutions per minute.

NOTE: RCF and RPM are not the same (i.e., $3000 \times g$ is NOT equivalent to 3000 RPM.) Check the centrifuge operating guide for instructions on converting g-force to RPM, or use the above formula.

Flow Rate

The filtration rate is affected by several operating parameters, including sample concentration, starting volume, relative centrifugal force, type of rotor used, membrane cut-off, and temperature. When concentrating dilute solutions, swinging-bucket and fixed-angle rotors yield comparable flow rates.

For solutions containing over 10% solids, a starting volume greater than 5 mL typically results in reduced flow rates. A volume of 5 mL or less produces the fastest flow rates because this limits the amount of solids that can pack onto and blind the membrane.

Spin times must be lengthened when working at low temperatures. At 4 °C, flow rates are approximately 1.5 times slower than at 25 °C. Viscous solutions may also require longer spin times. For example, using a Centriprep 10K NMWL device, a 1 mg/mL BSA solution in 50% glycerin would take 5 times longer to concentrate than the identical protein in an aqueous buffer solution.

Retention and Recovery

The anisotropic, hydrophilic membranes in Centriprep centrifugal filter devices are characterized by a nominal molecular weight limit; i.e., their ability to reject molecules above a specified molecular weight.

Because it is an easy parameter to work with, molecular weight is used in rating membrane permeability and selectivity based on results achieved with well-characterized proteins. But molecular weight may not be valid for all solutes. For instance, retentivity may be greater for a globular molecule than for a linear molecule having the same nominal molecular weight. The effects of pH and ionic strength on a molecule's dimensions and behavior in a particular solution must also be considered when assessing solute retentivity.

Low solute recovery in the retentate may indicate possible adsorptive losses and/or solute passage through the membrane. Adsorptive losses depend on solute concentration, the nature of solute (hydrophobic or hydrophilic), temperature, time of contact with component surfaces, sample composition, and pH.

Typical Retentate Recovery

Solute & Starting Concentration	Nominal MW	% Retentate Recovery/NMWL (kDa)			
		3,000	10,000	30,000	50,000
IgG Fr. II (1 mg/ml)	156,000	95	90	90	90
Phosphorylase B (1 mg/ml)	97,400	90	90	85	85
Bovine serum albumin (1 mg/ml)	67,000	95	90	90	90
Ovalbumin (1 mg/ml)	45,000	95	95	90	90
α -Chymotrypsinogen (1 mg/ml)	25,000	90	90	70	70
Cytochrome c (0.25 mg/ml)	12,400	90	85	15	10
Protamine sulfate (1 mg/ml)	5,000–10,000	80	45	5	5
Vitamin B12 (0.2 mg/ml)	1,355	15	5	5	5
Riboflavin (saturated solution)	376	5	5	5	5

15 mL starting volume • temperature: 25 °C • swinging-bucket rotor

Results based on recommended spin times outlined in the "Concentration Volumes for Dilute Protein Solutions" section

Typical Protein Recovery, Centriprep Device, 30,000 NMWL

Concentration	% Retentate Recovery*
10 µg/mL	77.7 ± 5.6
100 µg/mL	80.3 ± 0.7
500 µg/mL	92.1 ± 2.5
1000 µg/mL	89.9 ± 2.4

bovine serum albumin • 15 mL starting volume
25 °C • g-force: 1500 × g • swinging-bucket rotor
two 25-minute spins

*± 1 SD

Desalting

For desalting or solvent exchange, the sample is concentrated until the equilibration point is reached. Filtrate is discarded, then the sample is reconstituted to the original volume by adding an appropriate solvent and vortex mixing. The sample is then concentrated and reconstituted once more. This process is repeated until the concentration of the contaminating microsolite is sufficiently reduced.

Desalting Example, Centriprep Device, 30,000 NMWL

The following example illustrates a procedure for sample desalting:

15 mL of 1 mg/mL bovine IgG Fraction II in 0.5M NaCl was concentrated down to approximately 3 mL in a Centriprep device with Ultracel YM-30 membrane. To begin desalting, the resulting concentrate was reconstituted back to 15 mL by adding 10 mM Tris HCl. The solution was then centrifuged a second time. After two more desalting spins, NaCl concentration dropped to 4 mM, for a salt removal of 99%.

Spin #	Protein Recovery	NaCl Concentration
Initial Sample	—	500 mM
1	95.1%	100 mM
2	94.2%	20 mM
3	94.0%	4 mM

Bovine IgG Fraction II (1 mg/mL) • 15 mL starting volume •
g-force: 1500 × g swinging-bucket rotor • 25 °C • 20-minute spin

Biological Integrity

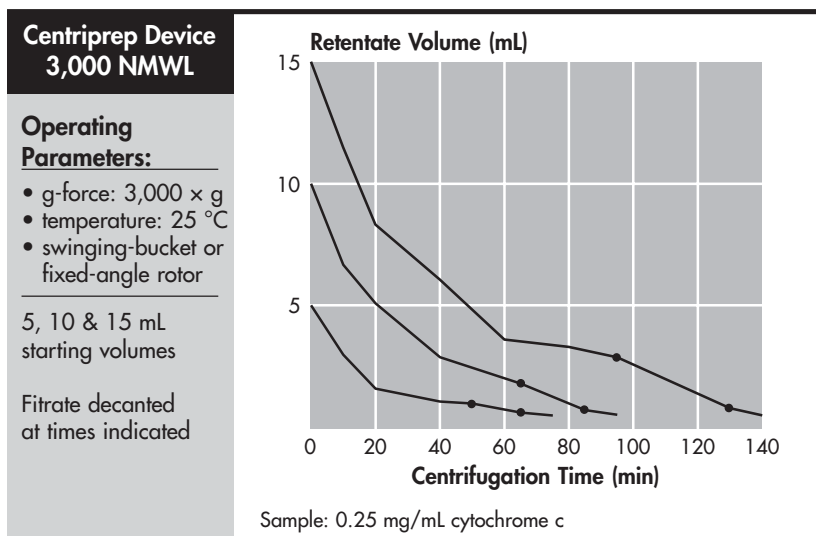
To demonstrate the enzyme activity remaining in the retentate after centrifugation, 15 mL of glucose-6-phosphate dehydrogenase containing 1 unit of enzyme activity/mL and 1 mg/mL bovine serum albumin (to minimize nonspecific adsorption) was spun in a Centriprep device with Ultracel YM-10 membrane for 60 minutes at $3000 \times g$ (two spins, with filtrate decanted between spins). Approximately 88% of the original activity was recovered.

NOTE: A unit is the amount of activity that will oxidize 1μ mole of glucose-6-phosphate to 6-phosphogluconate per minute in the presence of NADP at pH 7.8, 30°C .

Performance Figures

Millipore has measured Centriprep device performance using common dilute protein solutions, as well as cellular solutions. We have also tested the effect of relative centrifugal force on all Centriprep models.

Typical Filtration Profile, Centriprep Device with Ultracel YM-3 Membrane



Centriprep Device 3,000 NMWL

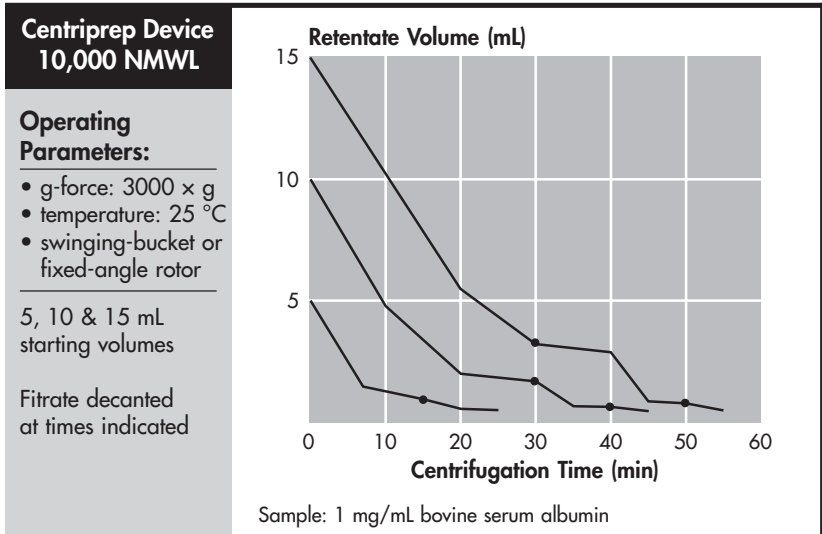
Operating Parameters:

- g-force: $3,000 \times g$
- temperature: 25°C
- swinging-bucket or fixed-angle rotor

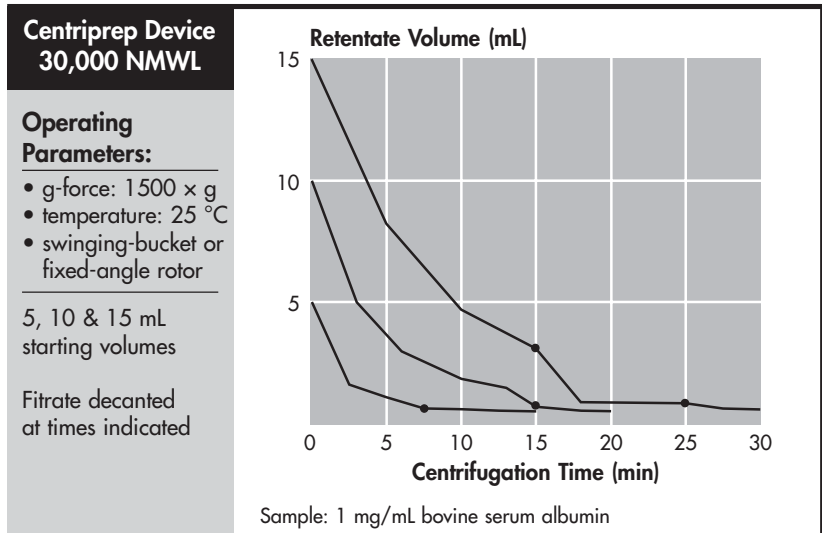
5, 10 & 15 mL
starting volumes

Filtrate decanted
at times indicated

Typical Filtration Profile, Centriprep Device with Ultracel YM-10 Membrane



Typical Filtration Profile, Centriprep Device with Ultracel YM-30 Membrane



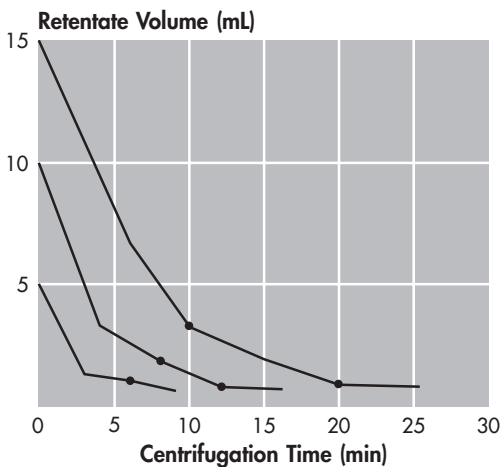
Typical Filtration Profile, Centriprep Device with Ultracel YM-50 Membrane

**Centriprep Device
50,000 NMWL****Operating
Parameters:**

- g-force: 1500 × g
- temperature: 25 °C
- swinging-bucket or fixed-angle rotor

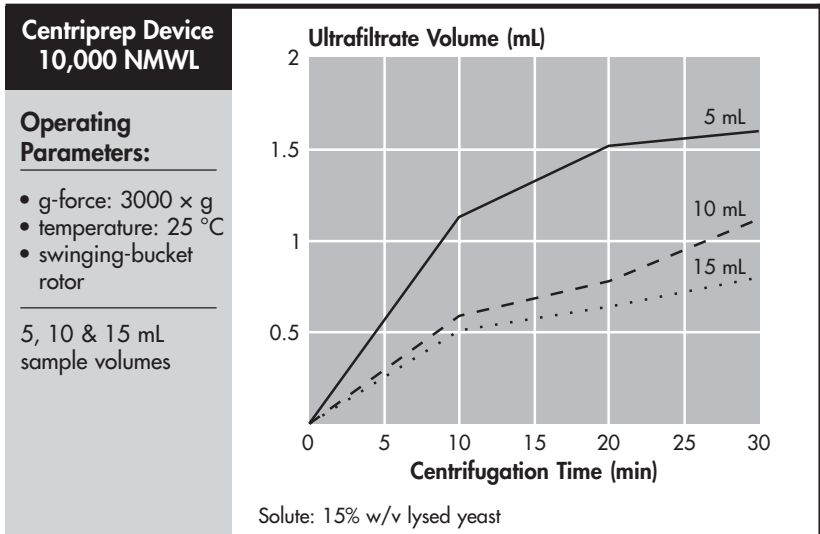
5, 10 & 15 mL
starting volumes

Filtrate decanted
at times indicated

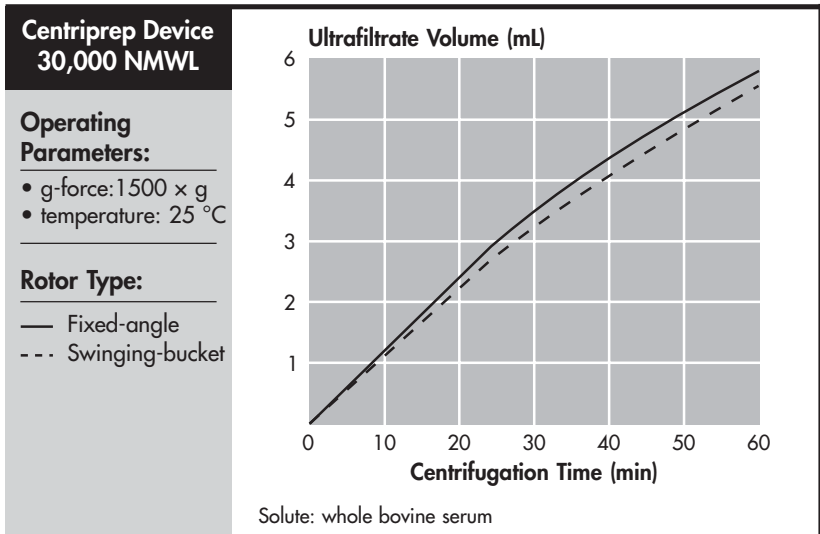


Sample: 1 mg/mL bovine serum albumin

Filtration Profile with Cell Lysate, Centriprep Device with Ultracel YM-10 Membrane



Filtration Profile with Whole Bovine Serum, Centriprep Device with Ultracel YM-30 Membrane



Filtration Profile with Hybridoma Cells, Centriprep Device with Ultracel YM-50 Membrane

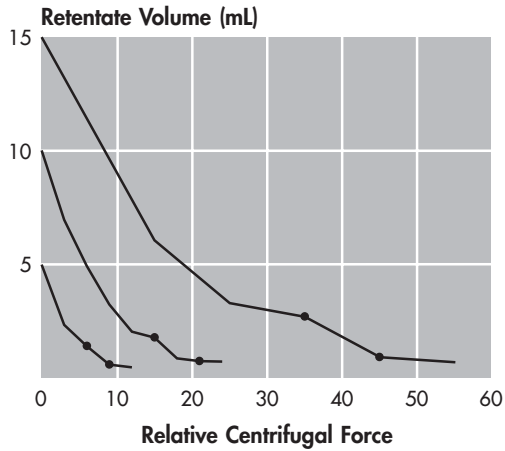
Centriprep Device 50,000 NMWL

Operating Parameters:

- g-force: 1500 × g
- temperature: 25 °C
- fixed-angle rotor

5, 10 & 15 mL
starting volumes

Filtrate decanted
at times indicated



Sample: 4.1 E5 murine hybridoma cells

Effect of Relative Centrifugal Force, Centriprep Device with Ultracel YM-3 Membrane

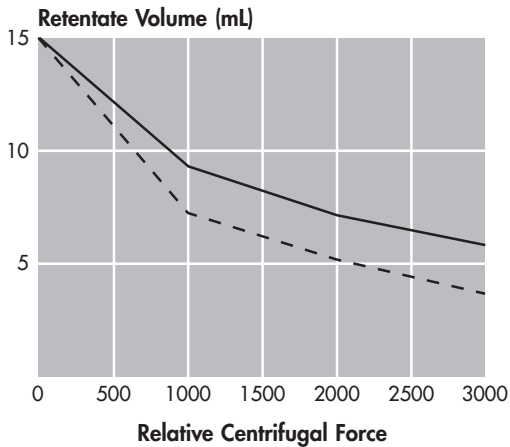
Centriprep Device 3,000 NMWL

Operating Parameters:

- 60-minute spin
- temperature: 25 °C

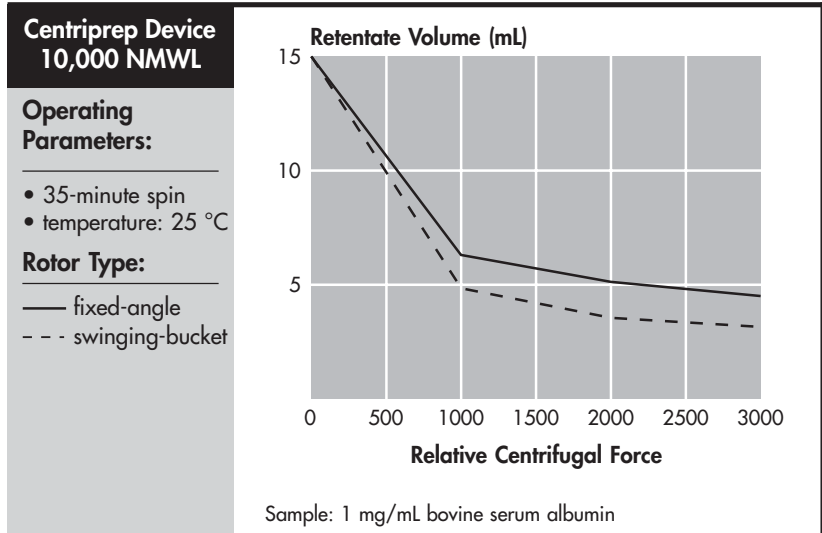
Rotor Type:

- fixed-angle
- - - swinging-bucket

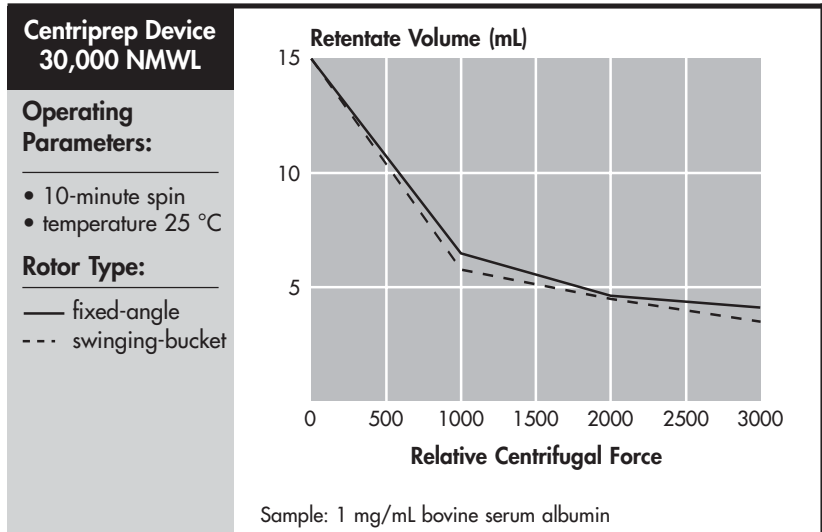


Sample: 0.25 mg/mL cytochrome c

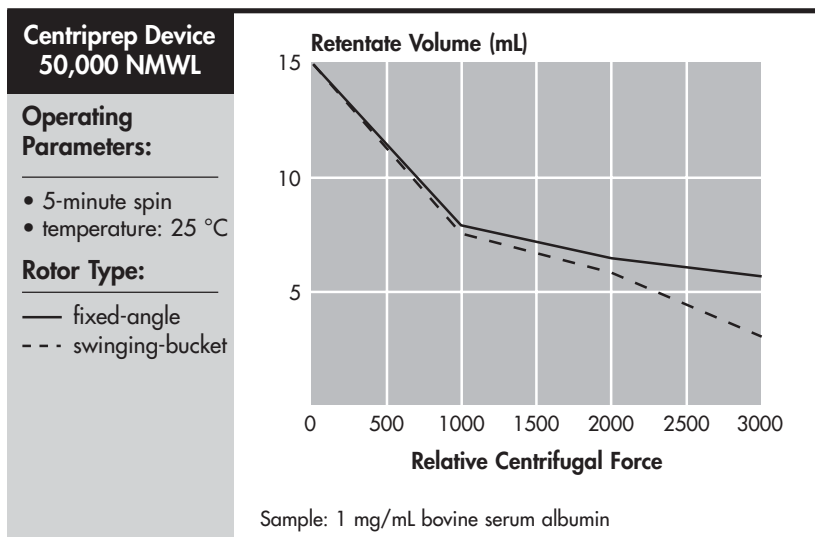
Effect of Relative Centrifugal Force, Centriprep Device with Ultracel YM-10 Membrane



Effect of Relative Centrifugal Force, Centriprep Device with Ultracel YM-30 Membrane



Effect of Relative Centrifugal Force, Centriprep Device with Ultracel YM-50 Membrane



Quantitating Recoveries

The density of most dilute protein solutions is nearly equal that of water (1 g/mL). Using this property, the retentate and filtrate recoveries can be quantified by weighing them, then converting the units from grams to milliliters. This provides a close approximation of the recovery volumes for protein solutions with concentrations up to roughly 20 mg/mL.

Total recovery, percent retentate recovery, and percent filtrate recovery may be calculated mathematically using the formulas provided. These formulas may then be entered into a data reduction program.

Weighing Procedure

1. Before use, weigh the sample container and an empty test tube (15 mL capacity).
2. Fill the sample container with solution and reweigh. Starting volume for volume estimates equals difference in container weight after adding solution.
3. Assemble the centrifugal filter device and spin per instructions in the “How to Use Centriprep Centrifugal Filter Devices” section. Decant filtrate into preweighed test tube. If further concentration is desired, spin a second time, decanting filtrate into test tube containing first filtrate.
4. To calculate filtrate volume, reweigh test tube plus filtrate(s), then subtract weight of empty test tube. To obtain concentrate volume, reweigh the sample container with retentate, then subtract container’s dry weight.

Solute Concentrations

Using an appropriate assay procedure (spectrophotometry, radio-immunoassay, refractive index, or conductivity) assay filtrate, retentate and a sample of the starting material to determine solute concentrations.

Calculations

With the volume and concentration data from the previous two sections, determine relative quantities of retentate and filtrate. Using the weights (and corresponding volumes), plus the measured concentrations, calculate relative quantities of retentate and filtrate recovered as follows:

$$\% \text{ retentate recovery} = 100 \times \frac{W_r \times C_r}{W_o \times C_o}$$

$$\% \text{ filtrate recovery} = 100 \times \frac{W_f \times C_f}{W_o \times C_o}$$

$$\% \text{ total recovery} = \% \text{ filtrate recovery} + \% \text{ retentate recovery}$$

W_r = total retentate weight before assay

W_o = starting material weight

W_f = filtrate weight

C_r = retentate concentration

C_o = starting material concentration

C_f = filtrate concentration

Product Specifications

Sample container capacity: 15 mL

Final concentrate volume, 25 °C: 0.6–0.7 mL

Deadstop volume: 0.7 mL

Filtrate collector capacity: 12 mL

Maximum relative centrifugal force of Centriprep filter device:

■ Ultracel YM-3 membrane: 3000 × g

■ Ultracel YM-10 membrane: 3000 × g

■ Ultracel YM-30 membrane: 1500 × g

■ Ultracel YM-50 membrane: 1500 × g

Active membrane surface area: 2.84 cm²

Hold-up volume of membrane and support: 0.5 mL

Dimensions:

Diameter of twist-lock cap: 36.5 mm

(cap resides outside centrifuge carrier)

Diameter of sample container: 28.1 mm

Length: 135 mm

Materials of Construction

Sample container: polycarbonate

Membrane support: polycarbonate

Filtrate collector: polycarbonate

Twist-lock cap: nylon

Air-seal cap: polypropylene

Membrane: Ultracel YM regenerated cellulose membrane

Product Ordering Information

Centriprep centrifugal filter devices are offered in packages of 8, 24 and 96 units. All packages include sample containers, filtrate collectors, twist-lock caps and air-seal caps. For easy identification, Centriprep centrifugal filter devices are color-coded as follows:

Ultracel YM-3 membrane – yellow base


Ultracel YM-10 membrane – green base

Ultracel YM-30 membrane – clear base

Ultracel YM-50 membrane – rose base

See the Technical Assistance section for information about contacting Millipore.

Centriprep Centrifugal Filter Devices with Ultracel YM Membrane

NMWL	Product Catalogue Numbers		
	8/pk	24/pk	96/pk
For in vitro diagnostic use 			
10,000	4321	4304	4305
30,000	4322	4306	4307
For research use only			
3,000	4320	4302	4303
50,000	4323	4310	4311

Technical Assistance

For more information, contact the Millipore office nearest you. In the U.S., call **1-800-MILLIPORE** (1-800-645-5476). Outside the U.S., see your Millipore catalogue for the phone number of the office nearest you or go to our web site at www.millipore.com/offices for up-to-date worldwide contact information. You can also visit the tech service page on our web site at www.millipore.com/techservice.

For matters associated with Directive 98/79/EC on in vitro diagnostic medical devices, contact our European Representative:

Millipore Ireland BV,
Tullagreen, Carrigtwohill,
County Cork, Ireland

Standard Warranty

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