



Rotors, Tubes & Accessories

ULTRACENTRIFUGE



Since the introduction of the first commercial ultracentrifuge in 1949 — the classic Beckman Model L — Beckman Coulter has been at the forefront of centrifuge innovation. Although the physics of this basic separation technique never change, Beckman Coulter continually designs new and innovative rotors and accessories, and develops advanced methods that allow the forces of centrifugation to be applied in new ways.

This centrifuge product selection guide is designed to help you determine the most efficient centrifuge tools for your work.

Each section begins with a brief description of instruments that Beckman Coulter offers within that centrifuge category. Because biocontainment is a major concern in today's laboratories, Beckman Coulter provides a number of options that address this issue. Special biocontainment accessories are available across our centrifuge product line and are identified with this icon: 

Following the centrifuge descriptions, listings of their rotors are included with information on speed and g-force capability. Also included is information on tubes and bottles that can be used and the adapters they require.

Tubes and bottles are cross-referenced in a separate section which provides details on tube materials, chemical compatibility, tube designs, and tube closure options.

A reference section at the back of the guide includes quick-reference charts on instrument and tube selection, as well as frequently used formulas, and a listing of centrifuge literature and training tools available from Beckman Coulter.

Note: Many rotor parts (such as hinge pins and rotor lids) require engraving and/or factory installation and cannot be installed by the customer. For parts such as these, contact the Rotor Repair Center at (650) 857-1150, ext. 1537.

Ordering is Easy
Simply Call
1-800-742-2345 (USA)
Internet: <http://www.beckmancoulter.com>

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Ultracentrifugation

1

The Beckman Coulter line of ultracentrifuges covers the full range of applications, with the Optima™ series leading the way. The Optima series, with the convenience and reliability of an imbalance-tolerant drive, ushers in a new era in ultracentrifugation. It offers freon-free temperature control, calculation capabilities not possible with other ultracentrifuges, and an air-cooled drive system that is imbalance-tolerant.

Ultracentrifugation

1

Optima™ L-Series – In a Class By Itself



Optima L-100XP



Optima L-90K



Optima LE-80K

- Imbalance-tolerant drive allows visual balancing of rotor loads and eliminates the need for operators to weigh individual samples.
- Air-cooled drive and thermoelectric heating/cooling system use no chlorofluorocarbons.
- Optima L Series performs common calculations such as CsCl speed reductions, run conversions, and more.
- ESP™ Efficient Sedimentation Program simulates separations to optimize run times.
- Optima micro-ultracentrifuge models let you personalize your work space by repositioning these instruments wherever there is a standard electrical outlet.
- For work with biohazards, HEPA filter kits are available for all Optima series instruments. Floor model instruments can be fitted to Baker biosafety cabinets. Contact the Baker Company at:
P.O. Drawer E
Sanford Airport Road
Sanford, ME 04073 USA
1-800-992-2537
- Compact micro-ultracentrifuge models are sized for operation within laminar flow hoods.



For more information on Optima ultracentrifuges and personal micro-ultracentrifuges, order catalog CAT-8717.

Preparative Floor Models

	Part No. 220/240 VAC 60/50 Hz	Part No. 220/240 VAC 50 Hz	Max. Speed (rpm)	Max. g-force
Optima L-100XP	392052	392050	100,000	802,400
Optima L-80XP	392051	392049	80,000	548,000*
Optima L-90K	365672	365670	90,000	694,000
Optima LE-80K	365668	365667	80,000	548,000*

* Using the Type 90 Ti rotor at 80,000 rpm.

Ultracentrifugation

Optima™ MAX/MAX-E



Optima MAX

High-Capacity Personal Ultracentrifuges

		Part No.	Max. Speed (rpm)	Max. g-force
Optima MAX	220/240 VAC, 50 Hz	364300	130,000	1,019,000
	110 VAC, 60 Hz	364301	130,000	1,019,000
	100 VAC, 50/60 Hz	364302	130,000	1,019,000
Optima MAX-E	220/240 VAC, 50 Hz	364310	100,000	603,000
	110 VAC, 60 Hz	364311	100,000	603,000
	100 VAC, 50/60 Hz	364312	100,000	603,000

Optima TLX



Optima TLX

Micro-Ultracentrifuges

		Part No.	Max. Speed (rpm)	Max. g-force
Optima TLX	220/240 VAC, 50 Hz	361544	120,000	627,000
	110 VAC, 60 Hz	361545	120,000	627,000
	100 VAC, 50/60 Hz	361546	120,000	627,000

Airfuge® Air-Driven Micro-Ultracentrifuge



Airfuge Air-Driven Micro-Ultracentrifuge with digital tachometer

The unique Airfuge from Beckman Coulter is a miniature, air-driven ultracentrifuge recognized worldwide as a convenient, easy-to-use pelleting tool in research, clinical, and industrial laboratories. Efficient and simple to operate, the Airfuge has a line of general-purpose and special purpose rotors for a wide variety of small-volume applications.

Airfuge Air-Driven Micro-Ultracentrifuge Without Digital Tachometer			
	Part No.	Max. Speed (rpm)	Max. g-force
60 Hz/120V	340400	110,000	199,000
50 Hz/220V	340401	110,000	199,000

	Part No.	Max. Speed (rpm)	Max. g-force
60 Hz/120V	340400	110,000	199,000
50 Hz/220V	340401	110,000	199,000

Airfuge Air-Driven Micro-Ultracentrifuge With Digital Tachometer			
	Part No.	Max. Speed (rpm)	Max. g-force
60 Hz/120V	347854	110,000	199,000
50 Hz/220V	347855	110,000	199,000

	Part No.	Max. Speed (rpm)	Max. g-force
60 Hz/120V	347854	110,000	199,000
50 Hz/220V	347855	110,000	199,000

For more information on the Airfuge Air-Driven Micro-Ultracentrifuge, order bulletin DS-8042.

Instrument Classification

Each Beckman Coulter preparative ultracentrifuge carries a safety classification that defines which Beckman Coulter rotors may be safely operated in that centrifuge. The letter classifications (from A to T) take into account rotor energies, size of the rotor chamber, and instrument updates. The classification is indicated on a decal which should be above the rotor chamber opening on the top of your instrument or on the chamber door. If this decal is missing or you are unsure of your ultracentrifuge's correct classification, please call your local Beckman Coulter Service Engineer for assistance. Instruments currently being manufactured are classified as H, R, or S.

Before ordering a rotor, check the decal on your instrument to make certain it will accommodate the rotor selected. The Optima™ L series ultracentrifuges that are classified "S" and the L8 and L8M series ultracentrifuges can spin all* Beckman Coulter preparative ultracentrifuge rotors. Other instruments have lower classifications and the number of rotors which may be used is fewer. Each rotor listing on the following pages indicates the instrument classifications in which they can be used.

Beckman Coulter rotors and ultracentrifuges are designed and tested as complete systems, and engineered for safe, reliable operation. We do not test Beckman Coulter rotors in non-Beckman Coulter ultracentrifuges, nor non-Beckman Coulter rotors in Beckman Coulter ultracentrifuges. It is not recommended that Beckman Coulter rotors be used in other instruments or that rotors made by other manufacturers be used in Beckman Coulter ultracentrifuges.

Speed Reductions

When using any rotor, be sure to observe the instructions given in the appropriate Rotor Manual. Speed limitations lower than those given in this Product Selection Guide may be required because of weight considerations—the weight of a tube, a cap, or the density of the solution being centrifuged. Other considerations, such as the precipitation of cesium salt, require deration of the rotor as well. Use the equations of the CsCl deration curves given in the Rotor Manual to determine the correct rotor speed. If a Rotor Manual has been lost, contact your local Beckman Coulter office to request a replacement.

Preparative Floor Model Rotor Designations

All fixed-angle preparative floor model ultracentrifuge rotors are designated by the word Type, vertical-tube rotors by the symbol VT, near-vertical by the symbol NVT™, and swinging bucket rotors by the symbol SW. The symbol Ti means the rotor is made of titanium. The one exception is the Z-60 which is also a titanium rotor. All other rotors are made of aluminum.

k Factors

The *k* factors shown in the rotor charts can be used to compare the efficiency of various rotors for the material that will be centrifuged. They are a guide to the time, *t* (in hours), required to pellet a particle of known sedimentation coefficient, *s* (in Svedberg units): $t = k/s$.

Centrifugal Forces

The centrifugal forces given for rotors in these publications have been rounded to three significant figures using the formula

$$g = 1.12r \left(\frac{\text{rpm}}{1000} \right)^2, \text{ RPM} = \sqrt{\frac{\text{RCF}}{1.12r}}$$

where *r* is the radius in millimeters.

Tube Kits

For your ordering convenience, most Beckman Coulter Fixed-Angle Rotors are sold as Rotor Assemblies with a choice of Tube Kits. For rotors that accommodate OptiSeal™ and Quick-Seal® tubes, you can order kits with these tubes instead of a Rotor Package with capped tubes only. Each kit comes complete with up to 200 tubes, the appropriate number of cap assemblies or spacers, Vacuum Grease, and, in the case of the OptiSeal and Quick-Seal Kits, a Tube Rack. For complete ordering information, see the individual rotor listings that follow.

Use of Small Tubes

With the use of appropriate spacers and/or adapters, many rotors can accommodate tubes smaller than the tube cavities. When centrifuging small samples, use of these smaller tubes increases the efficiency and speeds the process. A chart of compatible tubes is provided with each rotor listing.

Innovative *g*-Max™ System

The *g*-Max system adds valuable capabilities to your Beckman Coulter ultracentrifuge rotors. Based on a unique approach to tube support within the rotor cavities, the system lets you run smaller volumes in Fixed-Angle, Vertical-Tube and Swinging Bucket Rotors with no reduction in *g*-force and at lower *k* factors to achieve separations in much shorter run times.

This system uses patented Beckman Coulter Quick-Seal bell-top tubes and floating spacers. Unlike conventional sleeve-type adapters, the *g*-Max spacers "float" on top of the tube which keeps the sample at the maximum radius of the tube cavity.

Note: To help you locate *g*-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type. To make it easy to order these tubes the first time, *g*-Max kits are available which include enough spacers to completely fill the rotor, as well as 50 Quick-Seal polyallomer tubes and two tools (one for spacer removal and one for tube removal). These kits are also listed.

* Except Type 15 rotors.

Quick-Reference Guide to Instrument Classification Rotor Compatibility

Beckman Coulter no longer offers rotors containing the required safety features that would allow them to operate in the following obsolete Ultracentrifuge Models: L, L2-50, L2-65, L2-65/75, L3-40/50, L4, L5, and L5B. Rotors are no longer available with mechanical overspeed devices for the following ultracentrifuges: L, L2-50, L3-40, L3-50, L5-30, and L5-40.

All ultracentrifuges with the following classifications are obsolete and no longer supported with replacement parts or service from Beckman Coulter: A, B, C, D, E, F, G, Q, and some L5/L5B instruments classified as H. The L5B is the newest of these and was last manufactured in 1983. Please contact your Beckman Coulter Sales/Service organization for assistance with any of these models.

Rotor	L7	L8/L8M	Optima™ L/LE	
	R	H	R	S
Type 100 Ti	•	•	•	•
Type 90 Ti	•	•	•	•
Type 80 Ti	•	•	•	•
Type 75 Ti	•	•	•	•
Type 70 Ti	•	•	•	•
Type 70.1 Ti	•	•	•	•
Type 65	•	•	•	•
Type 60 Ti	•	•	•	•
Type 55.2 Ti	•	•	•	•
Type 50 Ti	•	•	•	•
Type 50.2 Ti	•	•	•	•
Type 50.3 Ti	•	•	•	•
Type 50.4 Ti	•	•	•	•
Type 50	•	•	•	•
Type 45 Ti	•	•	•	•
Type 42.2 Ti	•	•	•	•
Type 42.1	•	•	•	•
Type 40.3	•	•	•	•
Type 40.2	•	•	•	•
Type 40	•	•	•	•
Type 35	•	•	•	•
Type 30.2	•	•	•	•
Type 30	•	•	•	•
Type 28	•	•	•	•
Type 25	•	•	•	•
Type 21	•	•	•	•
Type 19	•	•	•	•
Type 16	•	•	•	•
NVT 100	•	•	•	•
NVT 90	•	•	•	•
NVT 65.2	•	•	•	•
NVT 65	•	•	•	•

Rotor	L7	L8/L8M	Optima™ L/LE	
	R	H	R	S
VTi 90	•	•	•	•
VTi 80	•	•	•	•
VTi 65.1	•	•	•	•
VTi 65.2	•	•	•	•
VTi 65	•	•	•	•
VTi 50	•	•	•	•
VC 53	•	•	•	•
VAC 50	•	•	•	•
SW 65 Ti	•	•	•	•
SW 60 Ti	•	•	•	•
SW 56	•	•	•	•
SW 55 Ti	•	•	•	•
SW 50.1	•	•	•	•
SW 41 Ti	•	•	•	•
SW 40 Ti	•	•	•	•
SW 50 L	•	•	•	•
SW 39 L	•	•	•	•
SW 36	•	•	•	•
SW 32.1 Ti	•	•	•	•
SW 32 Ti	•	•	•	•
SW 30.1	•	•	•	•
SW 30	•	•	•	•
SW 28.1	•	•	•	•
SW 28	•	•	•	•
SW 27.1	•	•	•	•
SW 27	•	•	•	•
SW 25.2	•	•	•	•
SW 25.1	•	•	•	•
CF-32 Ti		•		•
Ti-15		•		•
Ti-14		•		•

Beckman Coulter Floor Model Ultracentrifuge Rotors by Use

1

Rotors for Centrifuging Extremely Small Particles

Rotor	Max. rpm	Max. g	k Factor	No. of Tubes x Nominal Tube Volume (mL) ¹	Nominal Rotor Capacity (mL)	For Use in Instruments Classified
Type 100 Ti	100,000	802,000	15	8 x 6.8	54	HRS
NVT 100	100,000	750,000	8	13 x 5.1	40.8	RS
Type 90 Ti	90,000	694,000	25	8 x 13.5	108	HRS
NVT 90	90,000	645,000	10	8 x 5.1	40.8	HRS
VTi 90	90,000	645,000	6	8 x 5.1	40.8	HRS
Type 70.1 Ti	70,000	450,000	36	12 x 13.5	162	HRS
NVT 65	65,000	402,000	21	8 x 13.5	108	HRS
NVT 65.2	65,000	416,000	15	16 x 5.1	81.6	HRS
VTi 65.1	65,000	400,700	13	8 x 13.5	108	HRS
VTi 65.2	65,000	416,000	10	16 x 5.1	81.6	HRS

Rotors for Centrifuging Small Particles in Volume

Type 70 Ti	70,000	504,000	44	8 x 39	312	HRS
Type 55.2 Ti	55,000	340,000	64	10 x 39	390	HRS
Type 50.2 Ti	50,000	302,000	69	12 x 39	468	HRS
VTi 50	50,000	242,000	36	8 x 39	312	HRS
Type 45 Ti	45,000	235,000	133	6 x 94	564	HRS

Rotors for Differential Flotation

Type 50.4 Ti	50,000	270,000	39	44 x 6.5	286	HRS
Type 42.2 Ti	42,000	223,000	9	72 x 230	76.5	HRS
Type 25	25,000	92,500	62	100 x 1	100	HRS

Rotor for Concentrating Large Particles in Volume

Type 19	19,000	53,900	951	6 x 250	1500	HRS
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Rotors for Isopycnic and Rate-Zonal Gradients

SW 60 Ti	60,000	485,000	45	6 x 4	24	HRS
SW 55 Ti	55,000	368,000	48	6 x 5.0	30	HRS
SW 41 Ti	41,000	288,000	124	6 x 13.2	79.2	HRS
SW 40 Ti	40,000	285,000	137	6 x 14	84	HRS

Rotor with Long, Slender Tubes for Rate-Zonal Gradients

SW 32.1 Ti	32,000	187,000	228	6 x 17	102	HRS
SW 28.1	28,000	150,000	276	6 x 17	102	HRS

Rotor for Larger-Volume Density Gradients

SW 32 Ti	32,000	175,000	204	6 x 38.5	231	HRS
SW 28	28,000	141,000	245	6 x 39	234	HRS

Continuous Flow and Zonal Rotors

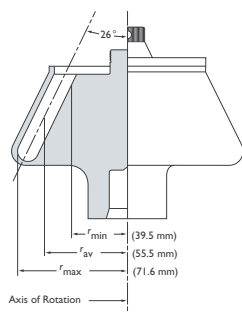
Rotor	Max. rpm	Max. g	Capacity (mL)	Typical Sample Volume (mL) ¹	Size Range of Particles Separated (S)	For Use in Instruments Classified
CF-32 Ti	32,000	102,000	430	>1000	>50	HS
Ti-15	32,000	102,000	1,675	50-200	>100	HS
Ti-14	48,000	172,000	665	20-50	20-100	HS

¹ Smaller-volume tubes may also be used with adapters and/or spacers. Check the rotor listing for more information.

Type 100 Ti

8 x 6.8 mL

Type 100 Ti



Fixed-Angle Rotor, Titanium

For use in instruments classified: **H R S**

Major applications: Rapid separation of plasmid DNA and rapid differential centrifugation of small particles.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
100,000	802,000	15	8 x 6.8 mL ½ x 2 ½ in 13 x 64 mm	54 mL

1

No. 363013. Type 100 Ti Rotor Assembly with 3 each 876089 O-rings, 3 each 839347 O-rings, and 2 each 363304 Overspeed Disks.

No. 363963. Quick-Seal® Tube Kit with 4 boxes 344619 Polyallomer Tubes, 1 package 365470 Spacers, 1 each 361668 Tube Removal Tool, 306812 Spinkote™ Lubricant, and 335148 Vacuum Grease. (Cordless Tube Topper and Tube Rack required.)

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k Factor	Max. Speed
Quick-Seal Polyallomer	363650	50	6.8	13 x 64	362307	—	802,000	17.0	100,000
	344619	50	6.0	13 x 64	365470	—	802,000	15.0	100,000
	362248	50	5.1	13 x 51	360270	—	802,000	13.5	100,000
	363960*	50	5.1	13 x 51	360270	—	802,000	13.5	100,000
	349621	50	3.5	13 x 32	360270	—	802,000	9.4	100,000
	363961*	50	3.5	13 x 32	360270	—	802,000	9.4	100,000
	345829	50	2.0	13 x 25	360270	—	802,000	7.0	100,000
	363962*	50	2.0	13 x 25	360270	—	802,000	7.0	100,000

*To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts

839347 O-ring for Rotor Handle
363304 Overspeed Disk, 100,000 rpm
363039 Rotor Handle
876089 O-ring for Rotor Lid

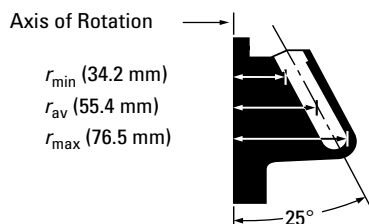
Spacers (Package of 8)

365470 fits 13 x 57 mm
360270 fits 13 x 51 mm
fits 13 x 30 mm
fits 13 x 25 mm
362307 fits 13 x 64 mm

Adapters/Spacers/Caps

360270 362307 365470



**Fixed-Angle Rotor, Titanium**For use in instruments classified: **H R S**

Major applications: Five-hour separation of plasmid DNA and rapid differential centrifugation of small particles.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
90,000	694,000	25	8 x 13.5 mL 5/8 x 3 in 16 x 76 mm	108 mL

1

No. 355530. Type 90 Ti Rotor Assembly with 3 each 839347 O-rings, 3 each 876089 O-rings, 2 each 355539 Overspeed Disks, and 356959 Tool.

No. 348179. Quick-Seal® Tube Kit with 2 boxes 342413 Polyallomer Tubes, 2 boxes 344322 Ultra-Clear™ Tubes, 12 each 342695 Spacers, 306812 Spinkote™ Lubricant, and 335148 Vacuum Grease. (Cordless Tube Topper Kit and Tube Rack required; see Tools, Accessories, and Supplies.)

No. 348180. Open-Top Tube Kit with 2 boxes 326814 Polyallomer Tubes, 2 boxes 344085 Ultra-Clear Tubes, 12 each 341968 Tube Caps, and 1 each 306812 Spinkote Lubricant, and 1 each 335148 Vacuum Grease. (331202 and 305075 Tools required; see Tools, Accessories, and Supplies.)

No. 361660. OptiSeal™ Tube Kit with 4 boxes of OptiSeal Tubes 361623, 12 Spacers 361670 (6 pkg. of 2), 1 OptiSeal Tube Rack 361642, 1 Tube Extraction Tool 361668, and 1 Spacer Removal Tool 338765.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal Polyallomer	361623	56	8.9	16 x 60	361670 ^a	—	694,000	21	90,000
Quick-Seal Polyallomer	342413	50	13.5	16 x 76	342695	—	694,000	25	90,000
	344622	50	10.0	16 x 67	344676	—	694,000	21	90,000
	345830	50	6.3	16 x 45	345828	—	694,000	14	90,000
	357334 ^b	50	6.3	16 x 45	345828	—	694,000	14	90,000
	356562	50	4.2	16 x 38	345828	—	694,000	11	90,000
	357332 ^b	50	4.2	16 x 38	345828	—	694,000	11	90,000
Quick-Seal Ultra-Clear	344322	50	13.5	16 x 76	342695	—	694,000	25	90,000
Polycarbonate Bottle/Assembly	355603 ^c	6	10.4	16 x 76	—	—	362,000	48	65,000
	355651 ^d	6	10.4	16 x 76	—	—	362,000	48	65,000
Thinwall Polyallomer	326814	50	13.5	16 x 76	341968	—	548,000	32	80,000
	326820	50	6.5	13 x 64	346256	303313	197,000	69	50,000
Thickwall Polyallomer	355640	25	10.0	16 x 76	338907	—	77,000	190	30,000
	355644	25	4.0	13 x 64	—	303313	197,000	69	50,000
Thickwall Polycarbonate	355630	25	10.0	16 x 76	338907	—	197,000	69	50,000 ^e
	355645	25	4.0	13 x 64	—	303313	197,000	69	50,000 ^e
Ultra-Clear	344085	50	13.5	16 x 76	341968	—	548,000	32	80,000
	344088	50	6.5	13 x 64	346256	303313	197,000	69	50,000
	344093	50	4.0	13 x 41	346256	303402	138,000	67	45,000
	344092	50	3.0	13 x 32	346256	303401	129,000	59	45,000
	344091	50	2.0	8 x 49	303624	303376	128,000	72	40,000

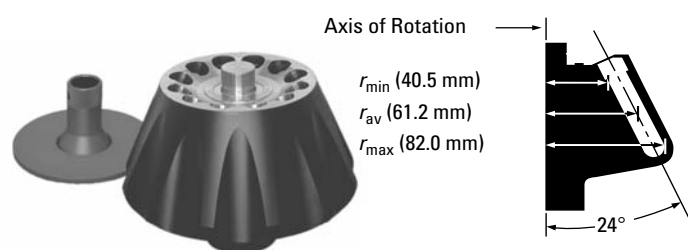
^a Set of two.^b To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

^c Bottle assembly.^d Bottle only.^e Maximum speeds given above are those which the tubes could withstand when tested at 25°C for 24 hours. Further tests have shown that the polycarbonate tubes can run at 75,000 rpm for six hours or at 65,000 rpm for eight hours.**Rotor Replacement Parts**

839347 O-ring for Rotor Handle
 356959 Tool, handle
 355539 Overspeed Disk, 90,000 rpm
 876089 O-ring for Rotor Lid

Adapters/Spacers/Caps

**Fixed-Angle Rotor, Titanium**For use in instruments classified: **H R S**

Major applications: Differential centrifugation of subcellular particles.

Max. RPM	Max. g	k Factor	Number of Tubes	Rotor Capacity Volume/Size
70,000	450,000	36	12 x 13.5 mL 5/8 x 3 in 16 x 76 mm	162 mL

1

No. 342184. Type 70.1 Ti Rotor Assembly with 3 each 011757 O-rings, 3 each 858125 O-rings, 2 each 335585 Overspeed Disks.

No. 348179. Quick-Seal® Tube Kit with 2 boxes 342413 Polyallomer Tubes, 2 boxes 344322 Ultra-Clear™ Tubes, 12 each 342695 Spacers, and 306812 Spinkote™ Lubricant, and 335148 Vacuum Grease. (Cordless Tube Topper Kit and Tube Rack required; see Tools, Accessories, and Supplies.)

No. 348180. Open-Top Tube Kit with 2 boxes 326814 Polyallomer Tubes, 2 each 344085 Ultra-Clear Tubes, and 12 each 341968 Tube Caps, and 1 each 306812 Spinkote Lubricant, and 335148 Vacuum Grease. (331202 and 305075 Tools required; see Tools, Accessories, and Supplies.)

No. 361660. OptiSeal™ Tube Kit with 4 boxes of OptiSeal Tubes 361623, 12 Spacers 361670 (6 pkg of 2), 1 OptiSeal Tube Rack 361642, 1 Tube Extraction Tool 361668, and 1 Spacer Removal Tool 338765.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal Polyallomer	361623	56	8.9	16 x 60	361670*	—	450,000	32	70,000
Quick-Seal Polyallomer	342413	50	13.5	16 x 76	342695	—	450,000	36	70,000
	344622	50	10.0	16 x 67	344676	—	450,000	34	70,000
	345830	50	6.3	16 x 45	345828	—	450,000	24	70,000
	357334†	50	6.3	16 x 45	345828	—	450,000	24	70,000
	356562	50	4.2	16 x 38	345828	—	450,000	17	70,000
	357332†	50	4.2	16 x 38	345828	—	450,000	17	70,000
Quick-Seal Ultra-Clear	344322	50	13.5	16 x 76	342695	—	450,000	36	70,000
Polycarbonate Bottle Assembly	355603	6	10.4	16 x 76	—	—	388,000	42	65,000
Thinwall Polyallomer	326814	50	13.5	16 x 76	341968	—	450,000	36	70,000
	326820	50	6.5	13 x 64	346256	303313	212,000	60	50,000
Thickwall Polyallomer	355640	25	10.0	16 x 76	—	—	82,700	199	30,000‡
	355644	25	4.0	13 x 64	—	303313	212,000	60	50,000‡
Thickwall Polycarbonate	355630	25	8.0	16 x 76	—	—	230,000	71	50,000‡
	355645	25	4.0	13 x 64	—	303313	212,000	60	50,000‡
Ultra-Clear	344085	50	13.5	16 x 76	341968	—	450,000	36	70,000
	344088	50	6.5	13 x 64	346256	303313	212,000	60	50,000
	344093	50	4.0	13 x 41	346256	303402	152,000	58	45,000
	344092	50	3.0	13 x 32	346256	303401	143,000	51	45,000
	344091	50	2.0	8 x 49	303624	303376	138,000	63	40,000

*Set of 2.

† To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

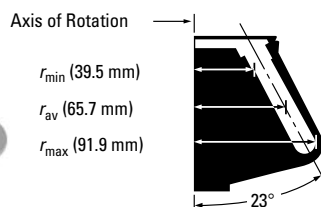
Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

‡ Maximum speeds given above are those which the tube could withstand when tested at 25°C for 24 hours. Further tests have shown that the polycarbonate tube can be run at 70,000 rpm for six hours or at 65,000 rpm for eight hours.

Rotor Replacement Parts

011757 O-ring for Rotor Handle
 337924 Rotor Handle
 335585 Overspeed Disk, 70,000 rpm
 858125 O-ring for Rotor Lid
 342183 Rotor Lid

Adapters/Spacers/Caps

**Fixed-Angle Rotor, Titanium**For use in instruments classified: **H R S**

Major applications: Differential centrifugation of subcellular fractions.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
70,000	504,000	44	8 x 39 mL 1 x 3 1/2 in 25 x 89 mm	312 mL

1

No. 337922. Type 70 Ti Rotor Assembly with 3 each 011757 O-rings, 3 each 870612 O-rings, and 2 each 335585 Overspeed Disks.

No. 348178. Quick-Seal® Tube Kit with 2 boxes 342414 Polyallomer Tubes, 2 boxes 344326 Ultra-Clear™ Tubes, 12 each 342699 Spacers, 306812 Spinkote™ Lubricant, and 335148 Vacuum Grease. (Cordless Tube Topper Kit and Rack required; see Tools, Accessories, and Supplies.)

No. 348172. Open-Top Tube Kit with 4 boxes 344367 Polyallomer Tubes, 10 each 337927 Tube Caps, and 1 each 306812 Spinkote Lubricant, and 335148 Vacuum Grease. (338841 and 305075 Tools required; see Tools, Accessories, and Supplies.)

No. 361662. OptiSeal™ Tube Kit with 4 boxes of Tubes 361625, 12 Spacers 361669 (6 pkg of 2), 1 OptiSeal Tube Rack 361646, 1 Tube Extraction Tool 361668, and 1 Spacer Removal Tool 338765.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal Polyallomer	361625	56	32.4	25 x 77	361669 ^a	—	504,000	44	70,000
Quick-Seal Polyallomer	342414	50	39.0	25 x 89	342699	—	504,000	44	70,000
	344623	50	33.0	25 x 83	344635	—	504,000	38	70,000
	343665	50	27.0	25 x 64	343448	—	504,000	31	70,000
	357346 ^b	50	27.0	25 x 64	343448	—	504,000	31	70,000
	343664	50	15.0	25 x 38	343448	—	504,000	24	70,000
	357343 ^b	50	15.0	25 x 38	343448	—	504,000	24	70,000
Quick-Seal Ultra-Clear	344326	50	39.0	25 x 89	342699	—	504,000	44	70,000
	344323	50	27.0	25 x 64	343448	—	504,000	31	70,000
	344324	50	15.0	25 x 38	343448	—	504,000	24	70,000
Polycarbonate Bottle Assembly	355618	6	26.3	25 x 89	—	—	371,000	59	60,000
Thinwall Polyallomer	344367	50	35.5	25 x 83	337927	—	504,000	43	70,000
	326823	50	38.5	25 x 89	331151	—	371,000	59	60,000
	326814	50	13.5	16 x 76	330860	303307	151,000	104	40,000
	326820	50	6.5	13 x 64	346256	303392	102,000	69	45,000
Thickwall Polyallomer	355642	25	30.0	25 x 89	338906 ^c	—	371,000	59	60,000
	355640	25	10.0	16 x 76	338907 ^c	303307	151,000	104	40,000
	355644	25	4.0	13 x 64	—	303392	102,000	69	45,000
Thickwall Polycarbonate	355631	25	30.0	25 x 89	338906 ^c	—	371,000	59	60,000
	355630	25	10.0	16 x 76	338907 ^c	303307	151,000	104	40,000
	355645	25	4.0	13 x 64	—	303392	102,000	69	45,000
Ultra-Clear	344058	50	38.5	25 x 89	331151	—	371,000	59	60,000
	344085	50	13.5	16 x 76	330860	303307	151,000	104	40,000
	344088	50	6.0	13 x 64	346256	303392	102,000	69	45,000

^a Set of two.

^b To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

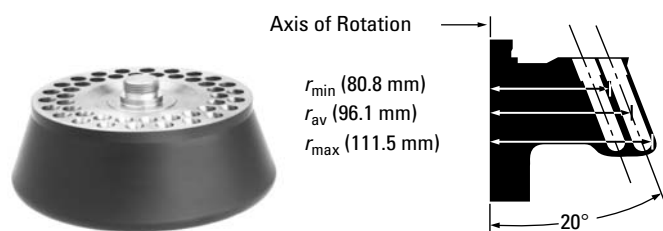
Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

^c Caps are optional for these Thickwall tubes. In the Type 70 Ti, the filling level for 355642 and 355631 is 16.5 mL. For 355640 and 355630, the filling level is 7.5 mL. Maximum speeds for these open-top tubes without a cap: Polycarbonate—45,000 rpm. Polyallomer—20,000 rpm. These speeds are those which the tubes could withstand when tested at 25°C for 24 hours. Further tests have shown that the polycarbonate tube can run at 50,000 rpm for four hours.

Rotor Replacement Parts

011757 O-ring for Rotor Handle
335585 Overspeed Disk, 70,000 rpm
337924 Rotor Handle
870612 O-ring for Rotor Lid
337923 Rotor Lid

Adapters/Spacers/Caps

**Fixed-Angle Rotor, Titanium**For use in instruments classified: **H R S**

Major applications: Differential flotation of lipoproteins, multisample pelleting, or gradient separations.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
50,000	270,000 312,000	39 33	44 x 6.5 mL ½ x 2½ in 13 x 64 mm	286 mL

No. 347299. Type 50.4 Ti Rotor Assembly with 2 each 870138 O-rings, 2 each 854519 O-rings, and 1 extra 330336 Overspeed Disk.

No. 356957. Quick-Seal® Tube Kit with 2 boxes 344619 Polyallomer Tubes, 2 boxes 344320 Ultra-Clear™ Tubes, 48 each 344389 Spacers, 338765 QS Adapter Removal Tool, 306812 Spinkote™ Lubricant, and 335148 Vacuum Grease. (Cordless Tube Topper Kit required; see Tools, Accessories, and Supplies.)

No. 356956. Open-Top Tube Kit and Tube Rack for lipoprotein flotation with 4 boxes 326820 Polyallomer Tubes, 48 each 303113 Tube Caps with short stems, and 1 each 306812 Spinkote Lubricant, and 335148 Vacuum Grease. (301875, 305075, and 841883 Tools required.)

No. 356958. Open-Top Tube Kit with 2 boxes 326820 Polyallomer Tubes, 2 boxes 344088 Ultra-Clear Tubes, 48 each 346256 Tube Caps with fill holes, and 1 each 306812 Spinkote Lubricant, and 335148 Vacuum Grease. (301875, 305075, and 841883 Tools required.)

No. 361659. OptiSeal™ Tube Kit with 4 boxes of Tubes 361621, 8 Spacers 361676 (4 pkg of 2), 1 OptiSeal Tube Rack 361638, 1 Tube Extraction Tool 361668, and 1 Spacer Removal Tool 338765.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal Polyallomer	361621	56	4.7	13 x 48	361676*	—	312,000	33	50,000
Quick-Seal Polyallomer	344619	50	6.0	13 x 64	344389	—	312,000	33	50,000
	345829	50	2.0	13 x 25	345827	—	312,000	15	50,000
	357329†	50	2.0	13 x 25	345827	—	312,000	15	50,000
Quick-Seal Ultra-Clear	344320	50	6.0	13 x 64	344389	—	312,000	33	50,000
Thinwall Polyallomer	326820	50	6.5	13 x 64	346256	—	312,000	33	50,000
Thickwall Polyallomer	355644	25	4.0	13 x 64	—	—	112,400	91	30,000
Thickwall Polycarbonate	355645	25	4.0	13 x 64	—	—	312,000	33	50,000
	355657	25	1.0	8 x 51	—	303823	252,900	40	45,000
Thinwall Ultra-Clear	344088	50	6.5	13 x 64	346256	—	312,000	33	50,000
	344091	50	2.0	8 x 49	303658	303823	252,900	40	45,000

* Set of 2.

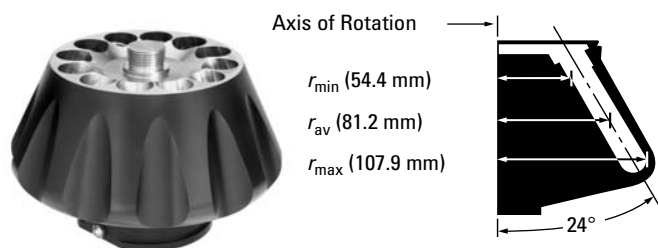
† To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts

330336 Overspeed Disk, 50,000 rpm
854519 O-ring for Rotor Handle
337904 Break-away Handle Assembly
870138 O-ring for Rotor Lid
347298 Rotor Lid

Adapters/Spacers/Caps

**Fixed-Angle Rotor, Titanium**For use in instruments classified: **H R S**

Note: This rotor cannot be used in 40,000 rpm F or H instruments or the L5-50E unless the instruments have been upgraded with a diffusion pump and vacuum indicator.

Major applications: Differential centrifugation of subcellular fractions.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
50,000	302,000	69	12 x 39 mL 1 x 3 1/2 in 25 x 89 mm	468 mL

No. 337901. Type 50.2 Ti Rotor Assembly with 3 each 834301 O-rings, 3 each 854519 O-rings, and 2 each 330336 Overspeed Disks.

No. 348178. Quick-Seal® Tube Kit with 2 boxes 342414 Polyallomer Tubes, 2 boxes 344326 Ultra-Clear™ Tubes, 12 each 342699 Spacers, 306812 Spinkote™ Lubricant, and 335148 Vacuum Grease. (Cordless Tube Topper Kit and Tube Rack required; see Tools, Accessories, and Supplies.)

No. 348177. Open-Top Tube Kit with 2 boxes 326823 Polyallomer Tubes, 2 boxes 344058 Ultra-Clear Tubes, and 12 each 331151 Tube Caps, and 1 each 306812 Spinkote Lubricant, and 335148 Vacuum Grease. (331202 and 305075 Tools required; see Tools, Accessories, and Supplies.)

No. 361662. OptiSeal™ Tube Kit with 4 boxes of Tubes 361625, 12 Spacers 361669 (6 pkg of 2), 1 OptiSeal Tube Rack 361646, 1 Tube Extraction Tool 361668, and 1 Spacer Removal Tool 338765.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal Polyallomer	361625	56	32.4	25 x 77	361669*	—	302,000	69	50,000
Quick-Seal Polyallomer	342414	50	39.0	25 x 89	342699	—	302,000	69	50,000
	344623	50	33.0	25 x 82	344635	—	302,000	68	50,000
	343665	50	27.0	25 x 64	343448	—	302,000	55	50,000
	357346**	50	27.0	25 x 64	343448	—	302,000	55	50,000
	343664	50	15.0	25 x 38	343448	—	302,000	39	50,000
	357343**	50	15.0	25 x 38	343448	—	302,000	39	50,000
Quick-Seal Ultra-Clear	344326	50	39.0	25 x 89	342699	—	302,000	69	50,000
	344323	50	27.0	25 x 64	343448	—	302,000	55	50,000
	344324	50	15.0	25 x 38	343448	—	302,000	39	50,000
Bottle Assembly Polycarbonate	355618	6	26.3	—	—	—	302,000	69	50,000
Thinwall Polyallomer	326823	50	38.5	25 x 89	331151	—	302,000	69	50,000
	326814	50	13.5	16 x 76	330860	303307	179,000	85	40,000
	326820	50	6.5	13 x 64	346256	303392	194,000	61	43,000
Thickwall Polyallomer	355642†	25	30.0	25 x 89	338906	—	302,000	69	50,000
	355640†	25	10.0	16 x 76	338907	303307	179,000	85	40,000
	355644	25	4.0	13 x 64	—	303392	194,000	61	43,000
Thickwall Polycarbonate	355631†	25	30.0	25 x 89	338906	—	302,000	69	50,000
	355630†	25	10.0	16 x 76	338907	303307	179,000	85	45,000
	355645	25	4.0	13 x 64	—	303392	194,000	61	43,000
Thinwall Ultra-Clear	344058	50	38.5	25 x 89	331151	—	302,000	69	50,000
	344085	50	13.5	16 x 76	330860	303307	179,000	85	40,000
	344088	50	6.5	13 x 64	346256	303392	194,000	61	43,000

** To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

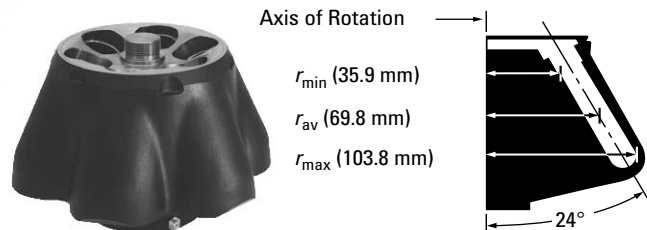
Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

† Caps are optional for these thickwall tubes. In the Type 50.2 Ti, the filling level for 355642 and 355631 is 16.5 mL. For 355640 and 355630, the filling level is 8 mL. Maximum speeds for these open-top tubes without a cap: Polycarbonate — 45,000 rpm. Polyallomer — 20,000 rpm. These speeds are those which the tubes could withstand when tested at 25°C for 24 hours. Further tests have shown that the polycarbonate tube can be run at 50,000 rpm for four hours.

Rotor Replacement Parts

330336 Overspeed Disk, 50,000 rpm
834301 Large O-ring for Rotor Lid
854519 Small O-ring for Rotor Lid
337904 Rotor Handle Assembly
337903 Rotor Lid

Adapters/Spacers/Caps

**Fixed-Angle Rotor, Titanium**For use in instruments classified: **H R S**

Note: This rotor cannot be used in 40,000 rpm F or H instruments or the L5-50E unless the instruments have been upgraded with a diffusion pump and vacuum indicator.

Major applications: Differential centrifugation of large volumes of subcellular fractions and viruses.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
45,000	235,000	133	6 x 94 mL 1½ x 4 in 38 x 102 mm	564 mL

No. 339160. Type 45 Ti Rotor Assembly with 3 each 854519 O-rings, 3 each 878260 O-rings, and 2 each 335458 Overspeed Disks.

No. 348175. Quick-Seal® Tube Kit with 4 boxes 345776 Polyallomer Tubes, 4 boxes 345778 Ultra-Clear™ Tubes, 8 each 342697 Spacers, 306812 Spinkote™ Lubricant, and 335148 Vacuum Grease. (Cordless Tube Topper Kit and Tube Rack required; see Tools, Accessories, and Supplies.)

No. 348176. Open-Top Tube Kit with 4 boxes 345775 Polyallomer Tubes, 4 boxes 345777 Ultra-Clear Tubes, and 8 each 330901 Tube Caps, and 1 each 306812 Spinkote Lubricant and 335148 Vacuum Grease. (331202 and 305075 Tools required; see Tools, Accessories, and Supplies.)

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k Factor	Max. Speed
Quick-Seal Polyallomer	345776	25	94.0	38 x 102	342697	—	235,000	133	45,000
Quick-Seal Ultra-Clear	345778	25	94.0	38 x 102	342697	—	235,000	133	45,000
Polycarbonate Bottle/Assembly	355622*	6	70.0	38 x 102	—	—	235,000	133	45,000†
	355651**	6	10.4	16 x 76	—	—	397,000	43	65,000
Thinwall Polyallomer	345775	25	94.0	38 x 102	330901	—	235,000	133	45,000
	326814	50	13.5	16 x 76	330860	303448	149,000	107	39,000
	326822	50	10.5	13 x 89	346256	303459	156,000	110	39,000
	326820	50	6.5	13 x 64	346256	303449	138,000	90	39,000
Thickwall Polyallomer	355643	25	81.0	38 x 102	338905†	—	235,000	133	45,000
	355640	25	10.0	16 x 76	338907†	303448	149,000	107	39,000
	355639	25	10.0	13 x 89	—	303459	156,000	110	39,000
	355641	25	3.5	11 x 80	—	350781	91,000	151	30,000
	355644	25	4.0	13 x 64	—	303449	138,000	90	39,000
Thickwall Polycarbonate	355628	25	81.0	38 x 102	338905†	—	235,000	133	45,000
	355630	25	10.0	16 x 76	338907†	303448	149,000	107	39,000
	355629	25	10.0	13 x 89	—	303459	156,000	110	39,000
	355632	25	3.5	11 x 80	—	350781	91,000	151	30,000
	355645	25	4.0	13 x 64	—	303449	138,000	90	39,000
Thinwall Ultra-Clear	345777	25	94.0	38 x 102	330901	—	235,000	133	45,000
	344085	50	13.5	16 x 76	330860	303448	149,000	107	39,000
	344087	50	10.5	13 x 89	346256	303459	156,000	110	39,000
	344088	50	6.5	13 x 64	346256	303449	138,000	90	39,000

* Bottle assembly. Reduce speed to 35,000 rpm when the bottle is centrifuged less than full (minimum fill volume is 35 mL).

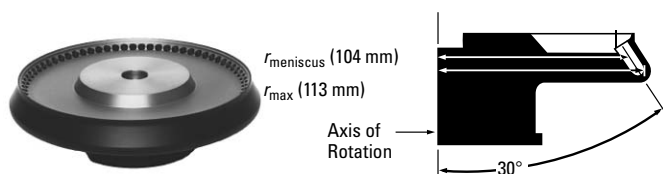
** Bottle only. Reduce speed to 35,000 rpm when the bottle is centrifuged less than full (minimum fill volume is 35 mL).

† Caps are optional for these Thickwall tubes. In the Type 45 Ti the filling level for 355643 and 355628 is 47 mL. For 355640 and 355630, the filling level is 8 mL. Maximum speeds for these open-top tubes without a cap: Polycarbonate — 30,000 rpm; Polyallomer — 15,000 rpm.

Rotor Replacement Parts

335458 Overspeed Disk, 45,000 rpm
339164 Rotor Handle
854519 O-ring, small, for Rotor Lid
878260 O-ring, large, for Rotor Lid
339163 Rotor Lid

Adapters/Spacers/Caps

**Fixed-Angle Rotor, Titanium**For use in instruments classified: **H R S**

Major applications: Differential flotation of lipoproteins, rapid separation of viruses and microsomes.

Max. RPM	Max. g	k Factor	Number of Tubes	Rotor Capacity Volume/Size
42,000	223,000	9	72 × 230 μ L .29 × .8 in 7 × 20 mm	16.5 mL

1

No. 343007. Type 42.2 Rotor Package with one bag of 100 each 342303 Cellulose Propionate Tubes, 1 each 330329 Overspeed Disk, 332688 Vise Assembly, 343008 Spanner Wrench, 878446 Forceps, and 1 each 306812 Spinkote™ Lubricant, and 335148 Vacuum Grease.

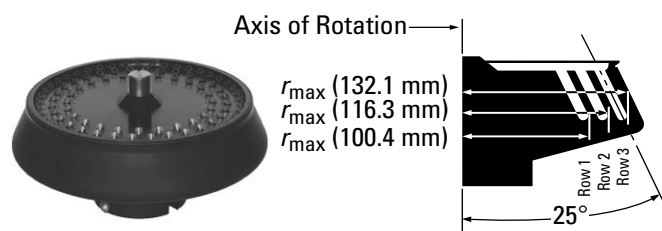
Tubes

Tube Style/Material	Part No.	Quantity	Volume (μ L)	Size (mm)	Caps/ Spacers (qty. 1)	g-Force	k Factor	Maximum Speed
Cellulose Propionate	342303	100	230	7 × 20	—	223,000	9	42,000
Thickwall Polyallomer	343621	100	230	7 × 20	—	223,000	9	42,000
Thickwall Polycarbonate	343775	100	230	7 × 20	—	223,000	9	42,000

Note: Originally this rotor was intended for small-sample lipoprotein applications and was called the LP 42 Ti. However, it has become a popular choice for processing a variety of microsamples, and the name has been changed to the Type 42.2 Ti to reflect its more general use.

Rotor Replacement Parts

330329 Overspeed Disk, 42,000 rpm
885028 O-ring for Rotor Lid

**Fixed-Angle Rotor, Aluminum**For use in instruments classified: **H R S**

Major applications: Differential flotation of many small samples of lipoproteins.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
25,000	70,300	84	100 x 1 mL	100 mL
	81,400	71	5/16 x 2 in	
	92,500	62	8 x 51 mm	

No. 347261. Type 25 Rotor Assembly with 3 each 011757 O-rings, 3 each 878272 O-rings, 2 each 330333 Overspeed Disks.

No. 348184. Quick-Seal® Tube Kit with 4 boxes 345831 Quick-Seal Polyallomer Tubes, 50 each 345824 Spacers, and 306812 Spinkote™ Lubricant, and 335148 Vacuum Grease. (Cordless Tube Topper Kit and Tube Rack required; see Tools, Accessories, and Supplies.)

No. 348635. Open-Top Tube Kit with 5 bags of 25 355657 Thickwall Polycarbonate Tubes, and 1 each 306812 Spinkote Lubricant, and 335148 Vacuum Grease.

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k Factor	Max. Speed
Thickwall Polycarbonate	355657	25	1.0	8 x 51	—	—	92,500	62	25,000
Quick-Seal Polyallomer	345831	50	1.0	8 x 51	345824	—	92,500	62	25,000

Note: Dimensions and forces for the three rows of tubes in the Type 25 rotor are as follows:

	Row 1	Row 2	Row 3
r_{min} (mm)	81.7	97.5	113.4
force (g)	57,200	68,300	79,400
r_{av} (mm)	91.1	106.9	122.8
force (g)	63,800	74,800	86,000
r_{max} (mm)	100.4	116.3	132.1
force (g)	70,300	81,400	92,500

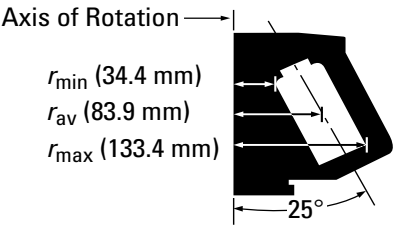
Rotor Replacement Parts

011757 O-ring for Rotor Handle
 330333 Overspeed Disk, 25,000 rpm
 335453 Overspeed Disk, 23,000 rpm
 878272 O-ring for Rotor Body
 347267 Rotor Handle
 347266 Rotor Lid

Spacers

345824





Fixed-Angle Rotor, Aluminum

For use in instruments classified: **H R S**
Major applications: Differential centrifugation of large volumes of viruses and large subcellular particles.

Max. RPM	Max. g	k Factor	Number of Tubes	Rotor Capacity Volume/Size
19,000	53,900	951	6 x 250 mL 2 3/8 x 4 3/4 in 60 x 120 mm	1500 mL

No. 325620. Type 19 Rotor Assembly with 3 each 325623 Gaskets, 3 each 801773 O-rings, and 2 extra 330331 Overspeed Disks.

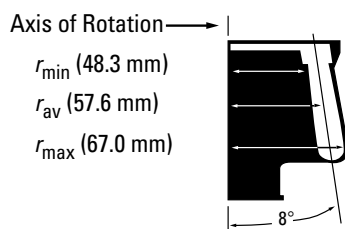
No. 325632. Type 19 Rotor Package with 6 each 334205 250-mL Bottle and Cap Assemblies, 1 each 355627 (pkg of 6) 250-mL Bottle, 6 each 812715 O-rings, 2 spare 801773 O-rings, and 1 each 306812 Spinkote™ Lubricant, and 335148 Vacuum Grease.

Bottle							
Tube Style/Material	Part No.	Quantity	Vol. (mL)	Size (mm)	g-Force	k Factor	Maximum Speed
Polyallomer	355627*	6	250.0	60 x 121	53,900	951	19,000
	334205**	1	250.0	60 x 121	53,900	951	19,000

* Bottle without Cap.
** Bottle with Cap Assembly.

Rotor Replacement Parts

- 325623 Gasket for Rotor Handle
- 325624 Rotor Handle
- 330331 Overspeed Disk, 19,000 rpm
- 801773 O-ring for Rotor Body
- 332826 Rotor Lid

**NVT™ Near-Vertical Tube Rotor, Titanium**For use in instruments classified: **R S**

Note: Non-precipitating solutions up to 1.7 g/mL in density can be run in this rotor without a reduction in rotor speed. For speed reductions for CsCl prescription, refer to rotor manual.

Major applications: Separation of plasmid or mitochondrial DNA in CsCl gradients in 2.5 - 4 h.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
100,000	750,000	8	8 x 5.1 mL ½ x 2 in 13 x 51 mm	40.8 mL

Rotor Package: No. 365898. NVT 100 Rotor with 1 each 366011 Vise Adapter, 1 each 858121 Torque Wrench, 1 each 976959 Torx Plug-wrench Adapter, Supplies, including 306812 Spinkote™ Lubricant, and 1 Spare 363304 Overspeed Disk.

Quick-Seal® Tube Kit: No. 360979. Tube Kit with 4 boxes 342412 Polyallomer Quick-Seal Tubes, 8 each 342883 Spacers, 1 each 348122 Tube Topper Rack, 1 each 361668 Tube Removal Tool. (Tube Topper Kit required, see Tools, Accessories, and Supplies.)

Tube or Bottle

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Spacers (qty. 1)	Floating Spacers (qty. 1)	g-Force	k Factor	Max. Speed
Quick-Seal	342412	50	5.1	13 x 51	342883	—	750,000	8	100,000
Polyallomer	345829	50	2.0	13 x 25	342883	345827	750,000	6	100,000
	357325*	50	2.0	13 x 25	342883	345827	750,000	6	100,000

* To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts**For Rotors Manufactured Prior to 1/2000**

363304 Overspeed Disk, 100,000 rpm
 365892 Rotor Plug, Hex style†
 342882 Gasket for Rotor Plug
 365891 Hex Plug-wrench Adapter

For Rotors Manufactured After 1/2000

363304 Overspeed Disk, 100,000 rpm
 368546 Rotor Replacement Plug (set of 8)
 342882 Gasket for Rotor Plug
 976959 Torx Adapter

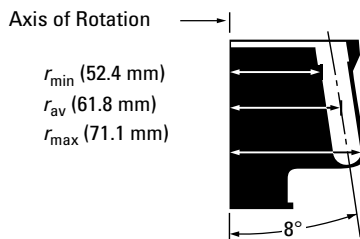
† This rotor plug is no longer available. If replacing all rotor plugs, use Torx style, P/N 368546.

Adapters/Spacers

342883

345827



**NVT™ Near-Vertical Tube Rotor, Titanium**For use in instruments classified: **H R S**

Note: Non-precipitating solutions up to 1.7 g/mL in density can be run in this rotor without a reduction in rotor speed. For speed reductions for CsCl prescription, refer to rotor manual.

Major applications: Separation of plasmid or mitochondrial DNA in CsCl gradients in 2.5 – 4 h.

Max. RPM	Max. g	k Factor	Number of Tubes	Rotor Capacity Volume/Size
90,000	645,000	10	8 x 5.1 mL ½ x 2 in 13 x 51 mm	40.8 mL

Rotor Package: No. 362752. NVT 90 Rotor with 1 each 342705 Vise, 1 each 858121 Torque Wrench, 1 each 976959 Torx Plug-wrench Adapter, and Supplies, including 306812 Spinkote™ Lubricant, and 1 spare 355539 Overspeed Disk.

OptiSeal™ Tube Kit: No. 360970. Tube Kit with 4 boxes 362185 Polyallomer OptiSeal Tubes, 8 each 362198 Spacers, 1 each 360534 Tube Rack, 1 each 361668 Tube Removal Tool, and 1 each 338765 Spacer Removal Tool.

Quick-Seal® Tube Kit: No. 360979. Tube Kit with 4 boxes 342412 Polyallomer Quick-Seal Tubes, 8 each 342883 Spacers, 1 each 348122 Tube Topper Rack, 1 each 361668 Tube Removal Tool. (Cordless Tube Topper Kit required, see Tools, Accessories, and Supplies.)

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Spacers (qty. 1)	Floating Spacers (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal Polyallomer	362185	56	4.9	13 x 51	362198	—	645,000	10	90,000
Quick-Seal Polyallomer	342412	50	5.1	13 x 51	342883	—	645,000	10	90,000
	345829	50	2.0	13 x 25	342883	345827	645,000	7	90,000
	357325*	50	2.0	13 x 25	342883	345827	645,000	7	90,000
Quick-Seal Ultra-Clear™	344075	50	5.1	13 x 51	342883	—	645,000	10	90,000

* To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts**For Rotors Manufactured Prior to 1/2000**

355539 Overspeed Disk, 90,000 rpm
342881 Rotor Plug, Hex style†
342882 Gasket for Rotor Plug

For Rotors Manufactured After 1/2000

355539 Overspeed Disk, 90,000 rpm
368546 Rotor Replacement Plug (set of 8)
368545 Rotor Replacement Plug (single)
342882 Gasket for Rotor Plug
976959 Torx Adapter

† This part number is no longer available. If replacing all rotor plugs, use Torx style, P/N 368545.

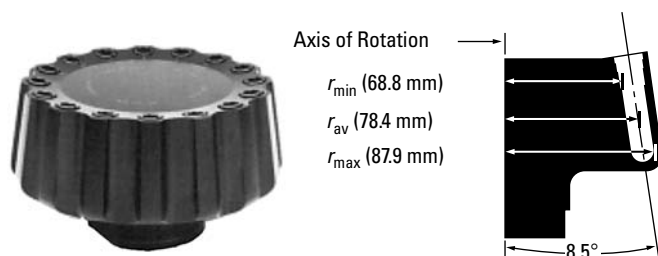
Adapters/Spacers

342883

345827

362198



**NVT™ Near-Vertical Tube Rotor, Titanium**For use in instruments classified: **H R S**

Note: Solutions up to 1.7 g/mL in density can be run in this rotor without a reduction in rotor speed.

Major applications: Separation of plasmid, mitochondrial, or chromosomal DNA, proteoglycans, and lipoproteins.

Max. RPM	Max. g	k Factor	Number of Tubes	Rotor Capacity Volume/Size
65,000	416,000	15	16 x 5.1 mL ½ x 2 in 13 x 51 mm	81.6 mL

Rotor Package: No. 361073. NVT 65.2 Rotor with 1 each 342705 Vise, 1 each 858121 Torque Wrench, 1 each 976959 Torx Plug-wrench Adapter, and Supplies, including 306812 Spinkote™ Lubricant, and 1 each 330338 Overspeed Disk.

OptiSeal™ Tube Kit: No. 360972. Tube Kit with 4 each 362185 Polyallomer OptiSeal Tubes, 16 each 362198 Spacers, 2 each 360534 Tube Racks, 1 each 361668 Tube Removal Tool, and 1 each 338765 Spacer Removal Tool.

Quick-Seal® Tube Kit: No. 360977. Tube Kit with 4 each 342412 Polyallomer Quick-Seal Tubes, 16 each 342883 Spacers, 1 each 348122 Tube Topper Tube Rack, and 1 each 361668 Tube Removal Tool. (Cordless Tube Topper Kit required, see Tools, Accessories, and Supplies.)

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Spacers (qty. 1)	Floating Spacers (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal Polyallomer	362185	56	4.9	13 x 51	362198	—	416,000	15	65,000
Quick-Seal Polyallomer	342412	50	5.1	13 x 51	342883	—	416,000	15	65,000
	345829	50	2.0	13 x 25	342883	345827	416,000	7	65,000
	357326*	50	2.0	13 x 25	342883	345827	416,000	7	65,000
Quick-Seal Ultra-Clear™	344075	50	5.1	13 x 51	342883	—	416,000	15	65,000

* To simplify ordering, this g-Max Kit™ includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts**For Rotors Manufactured Prior to 1/2000**

330338 Overspeed Disk, 65,000 rpm
342881 Rotor Plug, Hex style†
342882 Gasket for Rotor Plug

For Rotors Manufactured After 1/2000

330338 Overspeed Disk, 65,000 rpm
368546 Rotor Replacement Plug (set of 8)
368545 Rotor Replacement Plug (single)
342882 Gasket for Rotor Plug
976959 Torx Adapter

† This part number is no longer available. If replacing all rotor plugs, use Torx style, P/N 368545.

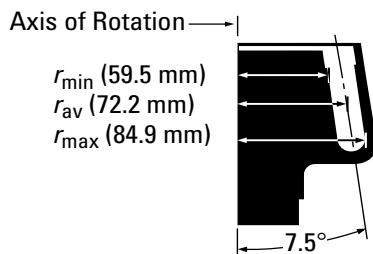
Adapters/Spacers

342883

345827

362198



**NVT™ Near-Vertical Tube Rotor, Titanium**For use in instruments classified: **H R S**

Note: Non-precipitating solutions up to 1.7 g/mL in density can be run in this rotor without a reduction in rotor speed.

Major applications: Separation of plasmid or mitochondrial DNA in CsCl gradients.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
65,000	402,000	21	8 x 13.5 mL 5/8 x 3 in 16 x 76 mm	108 mL

Rotor Package No. 362755. NVT 65 Near-Vertical Tube Rotor Assembly with 12 each 349290 Washers, 2 each 330338 Overspeed Disks, 1 each 342705 Vise, 1 each 858121 Torque Wrench, 1 each 976959 Torx Wrench Adapter.

OptiSeal™ Tube Kit: No. 360973. Tube Kit with 4 boxes 362181 Polyallomer OptiSeal Tubes, 8 each 362202 Spacers, 1 each 360538 Tube Rack, 1 each 361668 Tube Removal Tool, and 1 each 338765 Spacer Removal Tool.

Quick-Seal® Tube Kit: No. 360976. Tube Kit with 4 boxes 342413 Polyallomer Quick-Seal Tubes, 8 each 349289 Spacers, 1 each 348123 Tube Topper Tube Rack, 1 each 361668 Tube Removal Tool. (Cordless Tube Topper Kit required, see Tools, Accessories, and Supplies.)

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Spacers (qty. 1)	Floating Spacers (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal Polyallomer	362181	56	11.2	16 x 70	362202	—	402,000	17	65,000
Quick-Seal Polyallomer	342413	50	13.5	16 x 76	349289	—	402,000	21	65,000
	344622	50	10.0	16 x 67	349289	349901	402,000	15	65,000
	344621	50	8.0	16 x 58	349289	356571	402,000	11	65,000
	357337*	50	8.0	16 x 58	349289	356571	402,000	11	65,000
	345830	50	6.3	16 x 44	349289	349900	402,000	8	65,000
	357335*	50	6.3	16 x 44	349289	349900	402,000	8	65,000
Quick-Seal Ultra-Clear™	344322	50	13.5	16 x 76	349289	—	402,000	21	65,000

* To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts**For Rotors Manufactured Prior to 7/02**

330338 Overspeed Disk, 65,000 rpm
355875 Rotor Plug, Hex Style†
349290 Gasket for Rotor Plug
356306 Wrench Adapter for Hex Plug

For Rotors Manufactured After 7/02

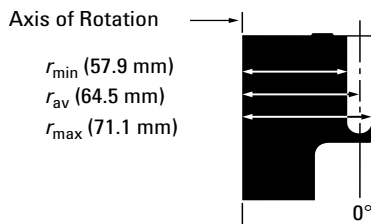
330338 Overspeed Disk, 65,000 rpm
392084 Rotor Plug (set of 8)
349290 Gasket for Rotor Plug
976959 Torx Wrench Adapter

† If replacing all rotor plugs, use Torx Style, P/N 392084.

Adapters/Spacers

349900 349901 349289 356571 362202



**Vertical-Tube Rotor, Titanium**For use in instruments classified: **H R S**

Note: Solutions up to 1.7 g/mL in density can be run in this rotor without reduction in rotor speed.

Major applications: High-speed density gradient separations.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
90,000	645,000	6	8 x 5.1 mL ½ x 2 in 13 x 51 mm	40.8 mL

Rotor Package: No. 362751. VTi 90 Rotor with 1 each 342705 Vise, 1 each 858121 Torque Wrench, 1 each 976959 Torx Plug-wrench Adapter, and Supplies, including 306812 Spinkote™ Lubricant, and 1 each 355539 Overspeed Disk.

OptiSeal™ Tube Kit: No. 360970. Tube Kit with 4 boxes 362185 Polyallomer OptiSeal Tubes, 8 each 362198 Spacers, 1 each 360534 Tube Rack, 1 each 361668 Tube Removal Tool, and 1 each 338765 Spacer Removal Tool.

Quick-Seal® Tube Kit: No. 360979. Tube Kit with 4 boxes 342412 Polyallomer Quick-Seal Tubes, 8 each 342883 Spacers, 1 each 348122 Tube Topper Tube Rack, and 1 each 361668 Tube Removal Tool. (Cordless Tube Topper Kit required, see Tools, Accessories, and Supplies.)

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Spacers (qty. 1)	Floating Spacers (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal Polyallomer	362185	56	4.9	13 x 51	362198	—	645,000	6	90,000
Quick-Seal Polyallomer	342412	50	5.1	13 x 51	342883	—	645,000	6	90,000
	345829	50	2.0	13 x 25	342883	345827	645,000	6	90,000
	349621	50	3.5	13 x 32	342883	356866	645,000	6	90,000
	357325*	50	2.0	13 x 25	342883	345827	645,000	6	90,000
Quick-Seal Ultra-Clear™	344075	50	5.1	13 x 51	342883	—	645,000	6	90,000

* To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts**For Rotors Manufactured Prior to 1/2000**

355539 Overspeed Disk, 90,000 rpm
342881 Rotor Plug, Hex style†
342882 Gasket for Rotor Plug

For Rotors Manufactured After 1/2000

355539 Overspeed Disk, 90,000 rpm
368546 Rotor Replacement Plug (set of 8)
368545 Rotor Replacement Plug (single)
342882 Gasket for Rotor Plug
976959 Torx Adapter

† This part number is no longer available. If replacing all rotor plugs, use Torx style, P/N 368545.

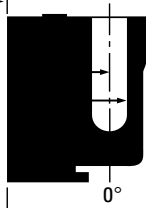
Adapters/Spacers

342883 345827 356866 362198





Axis of Rotation

 $r_{\min}$ (74.7 mm) r_{av} (81.3 mm) $r_{\max}$ (87.9 mm)**Vertical-Tube Rotor, Titanium**For use in instruments classified: **H R S**

Note: Solutions up to 1.7 g/mL in density can be run in this rotor without reduction in rotor speed.

Major applications: Isopycnic and rate-zonal centrifugation of small particles.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
65,000	416,000	10	16 x 5.1 mL ½ x 2 in 13 x 51 mm	81.6 mL

Rotor Package: No. 362754. VTi 65.2 Rotor with 1 each 342705 Vise, 1 each 858121 Torque Wrench, 1 each 976959 Torx Plug-wrench Adapter, and Supplies, including 306812 Spinkote™ Lubricant, and 1 each 330338 Overspeed Disk.

OptiSeal™ Tube Kit: No. 360972. Tube kit with 4 boxes 362185 Polyallomer OptiSeal Tubes, 16 each 362198 spacers, 2 each 360534 Tube Racks, 1 each 361668 Tube Removal Tool, and 1 each 338765 Spacer Removal Tool.

Quick-Seal® Tube Kit: No. 360977. Tube Kit with 4 boxes 342412 Polyallomer Quick-Seal Tubes, 16 each 342883 Spacers, 1 each 348122 Tube Topper Tube Rack, and 1 each 361668 Tube Removal Tool. (Cordless Tube Topper Kit required, see Tools, Accessories, and Supplies.)

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Spacers (qty. 1)	Floating Spacers (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal Polyallomer	362185	56	4.9	13 x 51	362198	—	416,000	10	65,000
Quick-Seal Polyallomer	342412	50	5.1	13 x 51	342883	—	416,000	10	65,000
	345829	50	2.0	13 x 25	342883	345827	416,000	10	65,000
	357326*	50	2.0	13 x 25	342883	345827	416,000	10	65,000
Quick-Seal Ultra-Clear™	344075	50	5.1	13 x 51	342883	—	416,000	10	65,000

* To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts**For Rotors Manufactured Prior to 1/2000**

330338 Overspeed Disk, 65,000 rpm
342881 Rotor Plug, Hex style†
342882 Gasket for Rotor Plug

For Rotors Manufactured After 1/2000

330338 Overspeed Disk, 65,000 rpm
368546 Rotor Replacement Plug (set of 8)
368545 Rotor Replacement Plug (single)
342882 Gasket for Rotor Plug
976959 Torx Adapter

† This part number is no longer available. If replacing all rotor plugs, use Torx style, P/N 368545.

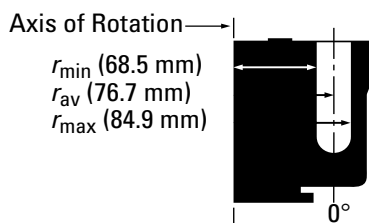
Adapters/Spacers

342883

345827

362198





Vertical-Tube Rotor, Titanium

For use in instruments classified: **H R S**

Note: Solutions up to 1.7 g/mL in density can be run in this rotor without reduction in rotor speed.

Major applications: Isopycnic and rate-zonal centrifugation of small particles.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
65,000	402,000	13	8 x 13.5 mL 5/8 x 3 in 16 x 76 mm	108 mL

Rotor Package: No. 362759. VTi 65.1 Rotor Assembly with 12 each 349290 Washers, 2 each 330338 Overspeed Disks, 1 each 342705 Vise, 1 each 306812 Spinkote™ Lubricant, 1 each 858121 Torque Wrench, 1 each 976959 Torx Wrench Adapter.

OptiSeal™ Tube Kit: No. 360973. Tube Kit with 4 boxes 362181 Polyallomer OptiSeal Tubes, 8 each 362202 Spacers, 1 each 360538 Tube Rack, 1 each 361668 Tube Removal Tool, and 1 each 338765 Spacer Removal Tool.

Quick-Seal® Tube Kit: No. 360976. Tube Kit with 4 boxes 342413 Polyallomer Quick-Seal Tubes, 8 each 349289 Spacers, 1 each 348123 Tube Topper Tube Rack, and 1 each 361668 Tube Removal Tool. (Cordless Tube Topper Kit required, see Tools, Accessories, and Supplies.)

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Spacers (qty. 1)	Floating Spacers (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal Polyallomer	362181	56	11.2	16 x 67	362202	—	402,000	13	65,000
Quick-Seal Polyallomer	342413	50	13.5	16 x 76	349289	—	402,000	13	65,000
	344622	50	10.0	16 x 67	349289	349901	402,000	13	65,000
	344621	50	8.0	16 x 58	349289	356571	402,000	13	65,000
	357337*	50	8.0	16 x 58	349289	356571	402,000	13	65,000
	345830	50	6.3	16 x 45	349289	349900	402,000	13	65,000
	357335*	50	6.3	16 x 45	349289	349900	402,000	13	65,000
Quick-Seal Ultra-Clear™	344322	50	13.5	16 x 76	349289	—	402,000	13	65,000

* To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts

For Rotors Manufactured Prior to 8/87

330338 Overspeed Disk, 65,000 rpm
349288 Rotor Plug, Square-hole Style†
349290 Plug Gasket

For Rotors Manufactured from 8/87 to 7/02

330338 Overspeed Disk, 65,000 rpm
355875 Rotor Plug, Hex-style†
349290 Gasket for Plug
356306 Wrench Adapter, Hex-style

For Rotors Manufactured After 7/02

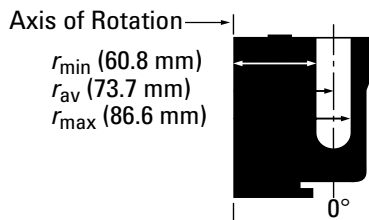
330338 Overspeed Disk, 65,000 rpm
392084 Rotor Plug, Torx (set of 8)
349290 Gasket for Rotor Plug
976959 Wrench Adapter for Torx Plug

† If replacing all rotor plugs, use Torx Style, P/N 392084.

Adapters/Spacers

349900 349901 349289 356571 362202



**Vertical-Tube Rotor, Titanium**For use in instruments classified: **H R S**

Note: Solutions up to 1.7 g/mL in density can be run in this rotor without reduction in rotor speed.

Major applications: Isopycnic and rate-zonal centrifugation.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
50,000	242,000	36	8 × 39 mL 1 × 3½ in 25 × 89 mm	312 mL

1

Rotor Package: No. 362758. VTi 50 Rotor with 1 each 332688 Vise, 1 each 889096 Torque Wrench, 1 each 355588 Hex Plug-wrench Adapter, and 2 spare 330336 Overspeed Disks.

OptiSeal™ Tube Kit: No. 360974. Tube kit with 4 boxes 362183 Polyallomer OptiSeal Tubes, 10 each 362204 Spacers, 1 each 360542 Tube Rack, and 1 each 361668 Tube Removal Tool.

Quick-Seal® Tube Kit: No. 360975. Tube Kit with 4 boxes 342414 Polyallomer Quick-Seal Tubes, 10 each 342417 Spacers, 1 each 348124 Tube Topper Tube Rack, and 1 each 361668 Tube Removal Tool. (Cordless Tube Topper Kit required, see Tools, Accessories, and Supplies.)

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Spacers (qty. 1)	Floating Spacers (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal Polyallomer	362183	56	36.2	25 × 86	362204	—	242,000	36	50,000
Quick-Seal Polyallomer	342414	50	39.0	25 × 89	342417	—	242,000	36	50,000
	343665	50	27.0	25 × 64	342417	343448	242,000	36	50,000
	343664	50	15.0	25 × 38	342417	343448†	242,000	36	50,000
	357344*	50	15.0	25 × 38	342417	343448	242,000	36	50,000
Quick-Seal Ultra-Clear™	344326	50	39.0	25 × 89	342417	—	242,000	36	50,000
	344323	50	27.0	25 × 64	342417	343448	242,000	36	50,000
	344324	50	15.0	25 × 38	342417	343448†	242,000	36	50,000

* To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor; 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

† Two required.

Rotor Replacement Parts**For Rotors Manufactured Prior to 8/87**

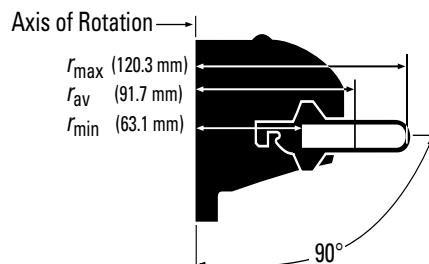
330336 Overspeed Disk, 50,000 rpm
340603 Rotor Plug, Four-hole style
340825 Gasket for Rotor Plug
340632 Four-hole Plug-wrench Adapter-2 Prongs

For Rotors Manufactured After 8/87

330336 Overspeed Disk, 50,000 rpm
355587 Rotor Plug, Hex Style*
340825 Gasket for Rotor Plug
355588 Hex Plug-wrench Adapter

*If replacing all Rotor Plugs, use Hex Style.

Adapters/Spacers

**Swinging-Bucket Rotor, Titanium Head, and Buckets**For use in instruments classified: **H R S**

Major applications: Rate-zonal centrifugation of proteins and RNA, differential centrifugation of subcellular fractions.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
60,000	485,000	45	6 x 4 mL 7/16 x 2 3/4 in 11 x 60 mm	24 mL

Rotor Package: No. 335650. SW 60 Ti Rotor with 001878 Cap Tool, 2 boxes 328874 Polyallomer Tubes, 2 boxes 344062 Ultra-Clear™ Tubes, 331313 Bucket Holder Rack, and Spare Parts/Supplies — 335148 Vacuum Grease, 306812 Spinkote™ Lubricant, 331155 Overspeed Disk, and 868638 Set of 4 O-rings for Buckets.

Rotor Assembly: No. 335649. SW 60 Ti Rotor and Bucket Set.

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Floating Spacers (qty. 1)	Adapters (qty. 1)	g-Force	k Factor	Max. Speed
Quick-Seal® Polyallomer	344624	50	1.5	11 x 25	344674	—	485,000	24	60,000
	357323*	50	1.5	11 x 25	344674	—	485,000	24	60,000
	344625	50	2.0	11 x 32	344674	—	485,000	29	60,000
	357324*	50	2.0	11 x 32	344674	—	485,000	29	60,000
Quick-Seal konical™ Polyallomer	358655	50	1.3	11 x 35	344674	358152	480,000	31	60,000
	358648	50	3.0	11 x 60	344674	358152	480,000	45	60,000
Polyallomer	328874	50	4.0	11 x 60	—	—	485,000	45	60,000
konical Polyallomer	358117	50	1.5	11 x 35	—	358152	480,000	31	60,000
	358118	50	3.0	11 x 60	—	358152	480,000	45	60,000
Thickwall Polyallomer	355636	25	3.0	11 x 60	—	—	485,000	45	60,000
Thickwall Polycarbonate	355635	25	3.0	11 x 60	—	—	485,000	45	60,000
Ultra-Clear	344062	50	4.0	11 x 60	—	—	485,000	45	60,000

* To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts

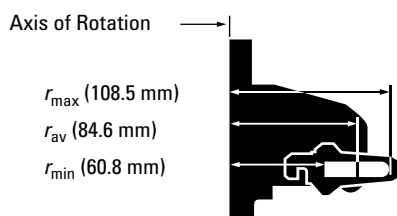
331155 Overspeed Disk, 60,000 rpm
 335459 Overspeed Disk, 54,000 rpm
 331313 Bucket Holder Rack
 332400 Rotor Stand
 868638 O-ring for Bucket, set of 4
 335645 Bucket Cap (each)
 337943 Bucket Assembly, Titanium, with Caps and O-rings, matched set of 6

Adapters/Spacers

344674

358152





Swinging-Bucket Rotor, Titanium Head, and Buckets (red buckets)

For use in instruments classified: **H R S**

Major applications: Rate-zonal separations of small particles.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
55,000	368,000	48	6 x 5 mL ½ x 2 in 13 x 51 mm	30 mL

Rotor Package: No. 342196. SW 55 Ti Rotor with 330070 Cap Tool, 2 boxes 326819 Polyallomer Tubes, 2 boxes 344057 Ultra-Clear™ Tubes, 331313 Bucket Holder Rack, and Spare Parts/Supplies — 306812 Spinkote™ Lubricant, 335148 Vacuum Grease, extra 328896 Overspeed Disk, and 824412 O-rings.

Rotor Assembly: No. 342194. SW 55 Ti Rotor and Bucket Set.

OptiSeal™ Tube Kit: No. 361661. Includes 4 boxes of Tubes 361627, 6 Spacers 361678 (3 pkg of 2), 1 OptiSeal Tube Rack 361650, 1 Tube Extraction Tool 361668.

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Floating Spacers (qty. 1)	Adapters (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal Polyallomer	361627	56	3.3	13 x 33	361678*	—	368,000	48	55,000
Quick-Seal® Polyallomer	345829	50	2.0	13 x 25	355535	—	368,000	29	55,000
	357327†	50	2.0	13 x 25	355535	—	368,000	29	55,000
Quick-Seal konical™ Polyallomer	358647	50	3.2	13 x 51	355535	358153	368,000	48	55,000
Polyallomer	326819	50	5.0	13 x 51	—	—	368,000	48	55,000
konical Polyallomer	358119	50	3.0	13 x 51	—	358153	368,000	48	55,000
Thickwall Polyallomer	349623	25	3.5	13 x 51	—	—	368,000	48	55,000
Thickwall Polycarbonate	349622	25	3.5	13 x 51	—	—	368,000	48	55,000
	344057	50	5.0	13 x 51	—	—	368,000	48	55,000
Ultra-Clear	344090	50	0.8	5 x 41	—	356860‡	269,000	64	48,000

* Set of 2.

†To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

‡Adapter 305527 can be used for speeds up to 25,000 rpm.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

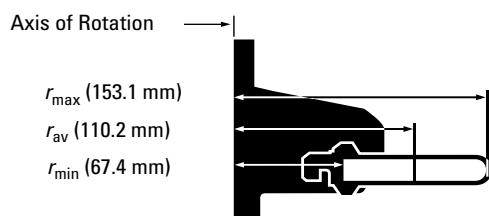
Rotor Replacement Parts

330336 Overspeed Disk, 50,000 rpm
 328896 Overspeed Disk, 55,000
 331313 Bucket Holder Rack
 332400 Rotor Stand
 342199 Bucket Assembly, Titanium, with Caps and O-rings, matched set of 6
 824412 O-ring for Bucket
 342190 Bucket Cap (each)

Adapters/Spacers

355535 356860 358153 361678





Swinging-Bucket Rotor, Titanium Head, and Buckets (black buckets)

For use in instruments classified: **H R S**

Major applications: Rate-zonal and isopycnic centrifugation of viruses, rate-zonal centrifugation of RNA.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
41,000	288,000	124	6 x 13.2 mL 5/16 x 3 1/2 in 14 x 89 mm	79.2 mL

Rotor Package: No. 331336. SW 41 Ti Rotor with 330070 Hinge Pin Tool, 331313 Bucket Holder Rack, 2 boxes 331372 Polyallomer Tubes, 2 boxes 344059 Ultra-Clear™ Tubes, and Spare Parts/Supplies — 335148 Vacuum Grease, 306812 Spinkote™ Lubricant, 330335 Overspeed Disk, and 331309 Gaskets for Buckets.

Rotor Assembly: No. 331362. SW 41 Ti Rotor and Bucket Set.

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Floating Spacers (qty. 1)	Adapters (qty. 1)	g-Force	k Factor	Max. Speed
Quick-Seal® Polyallomer	355537	50	5.9	14 x 47	355534	—	288,000	55	41,000
	355870	50	3.5	14 x 25	355534	—	288,000	27	41,000
	357330*	50	3.5	14 x 25	355534	—	288,000	27	41,000
Quick-Seal konical™ Polyallomer	358649	50	8.0	14 x 89	355534	358154	284,000	124	41,000
	358650	50	4.0	14 x 48	355534	358154	284,000	57	41,000
Polyallomer	331372	50	13.2	14 x 89	—	—	288,000	124	41,000
konical Polyallomer	358120	50	10.0	14 x 89	—†	358154	284,000	124	41,000
Ultra-Clear	344059	50	13.2	14 x 89	—	—	288,000	124	41,000

* To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

† Recommend 354468 Extractor Tool (konical tube adapters).

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts

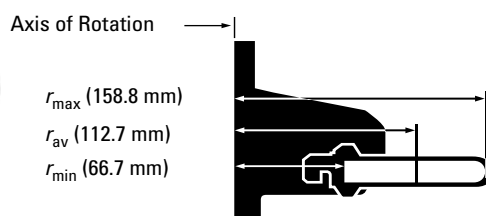
330335 Overspeed Disk, 41,000 rpm
 333761 Overspeed Disk, 36,000 rpm
 331313 Bucket Holder Rack
 332400 Rotor Stand
 333790 Bucket Assembly, Black Titanium, with Caps and Gaskets, matched set of 6
 331309 Gasket for Bucket
 331763 Caps, matched set of 6

Adapters/Spacers

355534

358154





Swinging-Bucket Rotor, Titanium Head, and Buckets (red buckets)

For use in instruments classified: **H R S**

Major applications: Rate-zonal centrifugation of proteins, RNA and subcellular particles.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
40,000	285,000	137	6 × 14 mL ⅝ × ¾ in 14 × 95 mm	84 mL

Rotor Package: No. 331301. SW 40 Ti Rotor with 330070 Hinge Pin Tool, 2 boxes 331374 Polyallomer Tubes, 2 boxes 344060 Ultra-Clear™ Tubes, 331313 Bucket Holder Rack, and Spare Parts/Supplies — 335148 Vacuum Grease, 306812 Spinkote™ Lubricant, 330335 Overspeed Disk, and 331309 Gaskets for Buckets.

Rotor Assembly: No. 331302. SW 40 Ti Rotor and Bucket Set.

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Floating Spacers (qty. 1)	Adapters (qty. 1)	g-Force	k Factor	Max. Speed
Quick-Seal® Polyallomer	355537	50	5.9	14 × 47	355534	—	285,000	61	40,000
	355870	50	3.5	14 × 25	355534	—	285,000	35	40,000
	357330*	50	3.5	14 × 25	355534	—	285,000	35	40,000
Quick-Seal konical™ Polyallomer	358650	50	4.0	14 × 48	355534	358154	280,000	57	40,000
	358649	50	8.0	14 × 89	355534	358154	280,000	130	40,000
Polyallomer	331374	50	14.0	14 × 95	—	—	285,000	137	40,000
konical Polyallomer	358120	50	10.0	14 × 89	—†	358154	285,000	124	40,000
Ultra-Clear	344060	50	14.0	14 × 95	—	—	285,000	137	40,000

* To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

† Recommend 354468 Extractor Tool (konical tube adapters).

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts

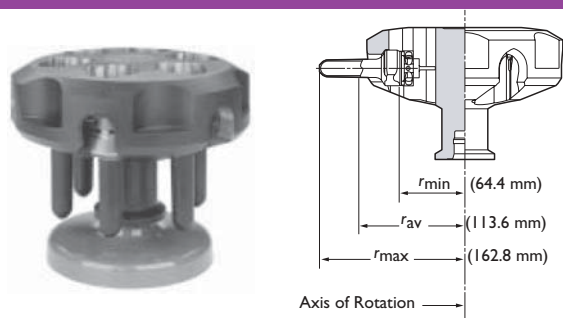
330335 Overspeed Disk, 40,000 rpm
 333761 Overspeed Disk, 36,000 rpm
 331313 Bucket Holder Rack
 332400 Rotor Stand
 333789 Bucket Assembly, Red Titanium, with Caps and Gaskets, matched set of 6
 331309 Gasket for Bucket
 331763 Caps, matched set of 6

Adapters/Spacers

355534

358154



**Swinging-Bucket Rotor and Buckets, Titanium**For use in instruments classified: **H R S**

Major applications: Separation of subcellular particles and viruses in density gradients.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
32,000	187,000	228	6 × 17 mL 5/8 × 4 in 16 × 102 mm	102 mL

Rotor Package: No. 369696. SW 32.1 Ti Rotor with 2 boxes 337986 Polyallomer Tubes (50 tubes/box), 2 boxes 344061 Ultra-Clear™ Tubes (50 tubes/box), 331186 Bucket Holder Rack, and Spare Parts/Supplies — 306812 Spinkote™ Lubricant, 335148 Vacuum Grease, 335456 Overspeed Disk, 815472 O-rings (qty. 24), and 978354 hooked O-ring Removal Tool.

Rotor Assembly: No. 369651. SW 32.1 Ti Rotor and Bucket Set.

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Floating Spacers (qty. 1)	Adapters (qty. 1)	g-Force	k Factor	Max. Speed
Quick-Seal®	356291	50	14.5	16 × 102	355579	—	187,000	199	32,000
Polyallomer	344622	50	10.5	16 × 67	355579	—	187,000	133	32,000
Bell-Top	344621	50	8.0	16 × 57	355579	—	187,000	102	32,000
	345830	50	6.5	16 × 44	355579	—	187,000	79	32,000
	356562	50	4.5	16 × 32	355579	—	187,000	56	32,000
Quick-Seal konical™	358653	50	12.5	16 × 102	355579	358155	187,000	205	32,000
Polyallomer	337986	50	16.5	16 × 96	—	—	187,000	225	32,000
konical Polyallomer	358123	50	13.5	16 × 93	—	358155	187,000	225	32,000
Ultra-Clear™	344061	50	17	16 × 102	—	—	187,000	228	32,000

To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts

335456 Overspeed Disk, 32,000 rpm
332400 Rotor Stand
369693 Bucket Set, with Caps and O-rings, set of 6
812715 O-ring for Bucket

Extra Buckets for the SW 32.1 Ti

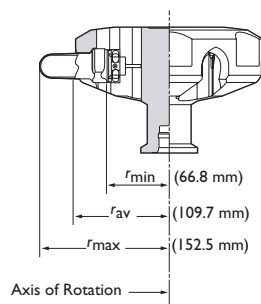
The buckets of the SW 32 can be used with the SW 32.1 rotor head.
369692 Bucket Set, with Caps and O-rings, set of 6

Adapters/Spacers

355579

358155





Swinging-Bucket Rotor and Buckets, Titanium

For use in instruments classified: **H R S**

Major applications: Separation of subcellular particles and viruses in density gradients.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
32,000	175,000	204	6 x 38.5 mL 1 x 3.5 in 25 x 89 mm	231 mL

1

Rotor Package: No. 369694. SW 32 Ti Rotor with Rotor with 2 boxes 326823 Polyallomer Tubes (50 tubes/box), 2 boxes 344058 Ultra-Clear™ Tubes (50 tubes/box), 1 box 355631 Polycarbonate Tubes (50 tubes/box), 331186 Bucket Holder Rack, and Spare Parts/Supplies — 306812 Spinkote™ Lubricant, 335148 Vacuum Grease, 335456 Overspeed Disk, 812715 O-rings (qty. 24), and 978354 hooked O-ring Removal Tool.

Rotor Assembly: No. 369650. SW 32 Ti Rotor and Bucket Set.

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Floating Spacers (qty. 1)	Adapters (qty. 1)	g-Force	k Factor	Max. Speed
Quick-Seal®	344623	50	33.5	25 x 83	355536	—	175,000	192	32,000
Polyallomer	343665	50	27.0	25 x 64	355536	—	175,000	146	32,000
Bell-Top	343664	50	15.0	25 x 38	355536	—	175,000	81	32,000
Quick-Seal	358651	50	28.0	25 x 83	355536	358156*	175,000	198	32,000
konical™	358654	50	22.5	25 x 76	355536	358156*	175,000	155	32,000
Polyallomer	358652	50	8.4	25 x 38	355536	358156*	175,000	74	32,000
Bell-Top									
konical	358126	50	31.5	25 x 89	—	358156*	175,000	156	32,000
Polyallomer	358125	50	25.5	25 x 76	—	358156*	175,000	156	32,000
Thickwall	355642	50	31.0	25 x 89	—	—	175,000	198	32,000
Polyallomer									
Thickwall	355631	50	31.0	25 x 89	—	—	175,000	202	32,000
Polycarbonate									
Ultra-Clear™	344058	50	38.5	25 x 89	—	—	175,000	204	32,000

* Package of 6.

To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts

335456 Overspeed Disk, 32,000 rpm
332400 Rotor Stand
369692 Bucket Set, with Caps and
O-rings, set of 6[†]
812715 O-ring for Bucket

Extra Buckets for the SW 32 Ti

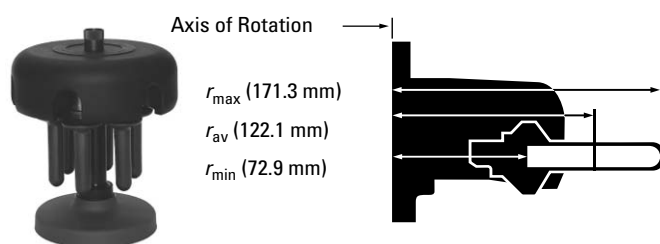
The buckets of the SW 32.1 can be used with the SW 32 rotor head.
369693 Bucket Set, with Caps and O-rings, set of 6

Adapters/Spacers

355579

358155





Swinging-Bucket Rotor, Aluminum Head, and Titanium Buckets

For use in instruments classified: **H R S**

Note: Zonal support band (if installed in centrifuge) must be removed before operating this rotor.

Major applications: Rate-zonal centrifugation of subcellular particles and viruses, rate-zonal centrifugation of subcellular fractions.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
28,000	150,000	276	6 x 17 mL 5/8 x 4 in 16 x 102 mm	102 mL

Rotor Package: No. 342214. SW 28.1 Rotor with 2 boxes 337986 Polyallomer Tubes, 2 boxes 344061 Ultra-Clear™ Tubes, 331186 Bucket Holder Rack, and Spare Parts/Supplies — 306812 Spinkote™ Lubricant, 335148 Vacuum Grease, 342211 Overspeed Disk, and 815472 O-rings.

Rotor Assembly: No. 342216. SW 28.1 Rotor and Bucket Set.

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Floating Spacers (qty. 1)	Adapters (qty. 1)	g-Force	k Factor	Max. Speed
Quick-Seal® Polyallomer	356291	50	18.0	16 x 102	355579	—	150,000	276	28,000
	344622	50	10.0	16 x 67	355579	—	150,000	160	28,000
	344621	50	8.0	16 x 58	355579	—	150,000	134	28,000
	345830	50	6.3	16 x 45	355579	—	150,000	99	28,000
	356562	50	4.2	16 x 32	355579	—	150,000	67	28,000
Quick-Seal konical™ Polyallomer	358653	50	12.5	16 x 102	355579	358155	148,000	276	28,000
Polyallomer	337986	50	17.0	16 x 102	—	—	150,000	276	28,000
konical	358123	50	14.5	16 x 102	—	358155	148,000	276	28,000
Ultra-Clear	344061	50	17.0	16 x 102	—	—	150,000	276	28,000

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts

330333 Overspeed Disk, 25,000 rpm
 331186 Bucket Holder Rack
 332400 Rotor Stand
 342211 Overspeed Disk, 28,000 rpm
 342180 Bucket Cap (each)
 342212 Bucket Assembly, Titanium, with Caps and O-rings, matched set of 6
 815472 O-ring for Bucket

Extra Buckets for the SW 28.1

The large-volume buckets of the SW 28 can be used with the SW 28.1 rotor head.

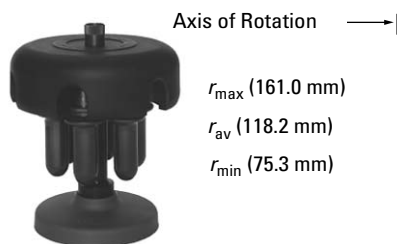
342217 Bucket Assembly SW 28, Titanium, with Caps and O-rings, matched set of 6

Adapters/Spacers

355579

358155





Swinging-Bucket Rotor, Aluminum Head, and Titanium Buckets

For use in instruments classified: **H R S**

Major applications: Differential centrifugation of subcellular fractions and viruses.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
28,000	141,000	246	6 x 39 mL 1 x 3½ in 25 x 89 mm	234 mL

Rotor Package: No. 342204. SW 28 Rotor with 2 boxes 344058 Ultra-Clear™ Tubes, 331186 Bucket Holder Rack, and Spare Parts/Supplies — 306812 Spinkote™ Lubricant, 335148 Vacuum Grease, 342211 Overspeed Disk, and 812715 O-rings.

Rotor Assembly: No. 342207. SW 28 Rotor and Bucket Set.

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Floating Spacers (qty. 1)	Adapters (qty. 1)	g-Force	k Factor	Max. Speed
Quick-Seal®	344623	50	33.5	25 x 83	355536	—	175,000	192	32,000
Polyallomer	343665	50	27.0	25 x 64	355536	—	175,000	146	32,000
Bell-Top	343664	50	15.0	25 x 38	355536	—	175,000	81	32,000
Quick-Seal	358651	50	28.0	25 x 83	355536	358156*	175,000	198	32,000
konical™	358654	50	22.5	25 x 76	355536	358156*	175,000	155	32,000
Polyallomer	358652	50	8.4	25 x 38	355536	358156*	175,000	74	32,000
Bell-Top									
konical	358126	50	31.5	25 x 89	—	358156*	175,000	156	32,000
Polyallomer	358125	50	25.5	25 x 76	—	358156*	175,000	156	32,000
Thickwall	355642	50	31.0	25 x 89	—	—	175,000	198	32,000
Polyallomer									
Thickwall	355631	50	31.0	25 x 89	—	—	175,000	202	32,000
Polycarbonate									
Ultra-Clear™	344058	50	38.5	25 x 89	—	—	175,000	204	32,000

* Package of 6.

To simplify ordering, this g-Max™ Kit includes enough spacers to fill rotor, 50 tubes, and required tools.

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Replacement Parts

- 330333 Overspeed Disk, 25,000 rpm
- 331186 Bucket Holder Rack
- 332400 Rotor Stand
- 342211 Overspeed Disk, 28,000 rpm
- 342217 Bucket Assembly, Titanium, with Caps and O-rings, matched set of 6
- 812715 O-ring for Bucket
- 342179 Bucket Cap (each)

Extra Buckets for the SW 28

The long slender buckets of the SW 28.1 can be used with the SW 28 rotor head.

- 342212 Bucket Assembly SW 28.1, Titanium, with Caps and O-rings, matched set of 6

Adapters/Spacers

355536

358156



Ultracentrifugation

Tubes, Caps & Replacement Parts for Discontinued Rotors

1

Type 16 Fixed-Angle Rotor DISCONTINUED 1999

No Replacement

For use in instruments classified: H R S

Tubes	P/N	Vol.	Size
Polypropylene Bottle	356011	250.0	62 x 122
Polycarbonate Bottle	356013	250.0	62 x 122
Polycarbonate Bottle w/Cap	357000	45.0	29 x 104
Polyallomer Bottle w/Cap	357001	45.0	29 x 104
Polyallomer Bottle/Screw Cap	357003	40.0	29 x 104
Polycarbonate Btl./Screw Cap	357002	40.0	29 x 104
Thickwall Polycarbonate	363664	40.0	29 x 104
Thickwall Polypropylene	357005	40.0	29 x 104
Bio-Vials	566353	4.0	

Replacement Parts:

011757	O-ring for Rotor Handle
347267	Rotor Handle
330331	Overspeed Disk, 19,000 rpm
961072	O-ring for Rotor Lid

Type 21 Fixed-Angle Rotor DISCONTINUED 1999

Recommended Replacement: Type 45 Ti

For use in instruments classified: H R S

Tubes	P/N	Vol.	Size	Caps/Spacer
Polycarbonate Bottle	355620	70.0	38 x 102	326905
Thinwall Polyallomer	345775	94.0	38 x 102	326891
Thickwall Polyallomer	355643	81.0	38 x 102	338903
Thickwall Polycarbonate	355628	81.0	38 x 102	338903
Thinwall Ultra-Clear™	345777	94.0	38 x 102	326891

Replacement Parts:

011757	O-ring for Rotor Handle
347267	Rotor Handle
330331	Overspeed Disk, 19,000 rpm
961072	O-ring for Rotor Lid

Type 28 Fixed-Angle Rotor DISCONTINUED 1999

No Replacement

For use in instruments classified: H R S

Tubes	P/N	Vol.	Size
Polyallomer Bottle w/Cap	357001	45.0	29 x 104
Polyallomer Bottle/Screw Cap	357003	40.0	29 x 104
Polycarbonate Bottle w/Cap	357000	45.0	29 x 104
Thickwall Polycarbonate	363664	40.0	29 x 104
Thickwall Polypropylene	357005	40.0	29 x 104
Polyallomer Tube w/Cap	357448	1.5	11 x 38

Replacement Parts:

011757	O-ring for Rotor Handle
342211	Overspeed Disk, 28,000 rpm
358997	Rotor Handle
870612	O-ring for Rotor Lid
330333	Overspeed Disk, 28,000 rpm
358349	Rotor Lid

Type 40 Fixed-Angle Rotor DISCONTINUED 1997

Recommended Replacement: Type 70.1 Ti

For use in instruments classified: A B C D F G H Q R S

Tubes	P/N	Vol.	Size	Caps/Spacer
Quick-Seal® Polyallomer	342413	13.5	16 x 76	342696
Quick-Seal Ultra-Clear™	344322	13.5	16 x 76	342696
Polycarbonate Bottle	355603	10.4		
Thinwall Polyallomer	326814	13.5	16 x 76	330860
Thickwall Polyallomer	355640	10.0	16 x 76	338907
Thickwall Polycarbonate	355630	10.0	16 x 76	338907
Thinwall Ultra-Clear	344085	13.5	16 x 76	330860

Replacement Parts:

011757	O-ring for Rotor Handle
330335	Overspeed Disk, 40,000 rpm
333761	Overspeed Disk, 36,000 rpm
334967	Rotor Handle
807474	O-ring for Rotor Lid

Type 40.2 Fixed-Angle Rotor DISCONTINUED 1982

Recommended Replacement: Type 50.4 Ti

For use in instruments classified: A B C D F G H N O P Q

Tubes	P/N	Vol.	Size	Caps/Spacer
Ultra-Clear	344088	6.5	13 x 64	346256
Quick-Seal Ultra-Clear	344320	6.0	13 x 64	344389
Polyallomer	326820	6.5	13 x 64	346256
Thickwall Polyallomer	355644	4.0	13 x 64	
Quick-Seal Polyallomer	344619	6.0	13 x 64	344389
Thickwall Polycarbonate	355645	4.0	13 x 64	

Type 50 Fixed-Angle Rotor DISCONTINUED 1997

Recommended Replacement: Type 70.1 Ti

For use in instruments classified: A B C D F G H Q R S

Tubes	P/N	Vol.	Size	Caps/Spacer
OptiSeal™ Polyallomer	361623	8.9	16 x 60	361670
Quick-Seal® Polyallomer	344621	8.0	16 x 58	344634
Polycarbonate Bottle	355615	8.5	16 x 64	
Thinwall Polyallomer	326826	10.0	16 x 64	330860
Thickwall Polyallomer	355646	8.0	16 x 64	338907
Thickwall Polycarbonate	355647	8.0	16 x 64	338907
Thinwall Ultra-Clear™	344089	10.0	16 x 64	330860

Replacement Parts:

011757	O-ring for Rotor Handle
334967	Rotor Handle
330336	Overspeed Disk, 50,000 rpm
335657	Mechanical Overspeed Device, 45,000 rpm
335458	Overspeed Disk, 45,000 rpm
801766	O-ring for Rotor Lid

Tubes, Caps & Replacement Parts for Discontinued Rotors

Type 50 Ti Fixed-Angle Rotor DISCONTINUED 1997

Recommended Replacement: Type 70.1 Ti

For use in instruments classified: B C D F G H Q R S

Tubes	P/N	Vol.	Size	Caps/ Spacer
OptiSeal™ Polyallomer	361623	8.9	16 x 60	361670
Quick-Seal® Polyallomer	342413	13.5	16 x 76	342696
Quick-Seal Ultra-Clear™	344322	13.5	16 x 76	342696
Polyarbonate Bottle	355603	10.4	16 x 76	
Thinwall Polyallomer	326814	13.5	16 x 76	330860
Thickwall Polyallomer	355640	10.0	16 x 76	338907
Thickwall Polycarbonate	355630	10.0	16 x 76	338907
Thinwall Ultra-Clear	344085	13.5	16 x 76	330860

Replacement Parts:

011757	O-ring for Rotor Handle
330336	Overspeed Disk, 50,000 rpm
807474	O-ring for Rotor Lid
326220	Rotor Lid

Type 50.3 Ti Fixed-Angle Rotor DISCONTINUED 1999

Recommended Replacement: type 50.4 Ti

For use in instruments classified: B C D F G H Q R S

Tubes	P/N	Vol.	Size	Caps/ Spacer
OptiSeal™ Polyallomer	361621	4.9	13 x 48	361676
Quick-Seal® Polyallomer	344619	6.0	13 x 64	344389
Quick-Seal Ultra-Clear™	344320	6.0	13 x 64	344389
Thinwall Polyallomer	326820	6.5	13 x 64	346256
Thickwall Polyallomer	355644	4.0	13 x 64	
Thickwall Polycarbonate	355645	4.0	13 x 64	
Thinwall Ultra-Clear	344088	6.5	13 x 64	346256

Replacement Parts:

011757	O-ring for Rotor Handle
330336	Overspeed Disk, 50,000 rpm
343146	Rotor Handle
801767	O-ring for Rotor Lid
326220	Rotor Lid

Type 55.2 Ti Fixed-Angle Rotor DISCONTINUED 1999

Recommended Replacement: Type 70 Ti or 50.2 Ti

For use in instruments classified: G H R S

Tubes	P/N	Vol.	Size	Caps/ Spacer
OptiSeal™ Polyallomer	361625	32.4	25 x 77	361669
Quick-Seal® Polyallomer	342414	39.0	25 x 89	342699
Quick-Seal Ultra-Clear™	344326	39.0	25 x 89	342699
Polyarbonate Bottle	355618	26.3	25 x 89	
Thinwall Polyallomer	326823	38.5	25 x 89	331151
Thickwall Polyallomer	355642	31.0	25 x 89	338906
Thickwall Polycarbonate	355631	31.0	25 x 89	338906
Thinwall Ultra-Clear	344058	38.5	25 x 89	331151

Replacement Parts:

328896	Overspeed Disk, 55,000 rpm
854519	Small O-ring for Rotor Lid
337904	Rotor Handle Assembly
878983	Large O-ring for Rotor Lid
342173	Rotor Lid

Type 60 Ti Fixed-Angle Rotor DISCONTINUED 1997

Recommended Replacement: Type 70 Ti

For use in instruments classified: B F G H R S

Tubes	P/N	Vol.	Size	Caps/ Spacer
OptiSeal™ Polyallomer	361625	32.4	25 x 77	361669
Quick-Seal® Polyallomer	342414	39.0	25 x 89	342699
Quick-Seal Ultra-Clear™	344326	39.0	25 x 89	342699
Polyarbonate Bottle	355618	26.3	25 x 89	
Thinwall Polyallomer	326823	38.5	25 x 89	331151
Thickwall Polyallomer	355642	31.0	25 x 89	338906
Thickwall Polycarbonate	355631	31.0	25 x 89	338906
Thinwall Ultra-Clear	344058	38.5	25 x 89	331151

Replacement Parts:

011757	O-ring for Rotor Handle
331155	Overspeed Disk, 60,000 rpm
858125	O-ring for Rotor Lid
331149	Rotor Lid

Type 65 Fixed-Angle Rotor DISCONTINUED 1997

Recommended Replacement: Type 70.1 Ti

For use in instruments classified: A B C D F G H Q R S

Tubes	P/N	Vol.	Size	Caps/ Spacer
OptiSeal™ Polyallomer	361623	8.9	16 x 60	361670
Quick-Seal® Polyallomer	342413	13.5	16 x 76	342696
Quick-Seal Ultra-Clear™	344322	13.5	16 x 76	342696
Polyarbonate Bottle	355603	10.4	16 x 76	
Thinwall Polyallomer	326814	13.5	16 x 76	330860
Thickwall Polyallomer	355640	10.0	16 x 76	338907
Thickwall Polycarbonate	355630	10.0	16 x 76	338907
Ultra-Clear	344085	13.5	16 x 76	330860

Replacement Parts:

011757	O-ring for Rotor Handle
331155	Overspeed Disk, 60,000 rpm
330338	Overspeed Disk, 65,000 rpm
807474	O-ring for Rotor Lid (if O-ring fits into lip around top of rotor body)
878073	O-ring for Rotor Lid (if O-ring fits onto the lid of the rotor)
334972	Rotor Handle

Type 80 Ti Fixed-Angle Rotor DISCONTINUED 1997

Recommended Replacement: Type 90 Ti

For use in instruments classified: F G H R S

Tubes	P/N	Vol.	Size	Caps/ Spacer
OptiSeal™ Polyallomer	361623	8.9	16 x 60	361670
Quick-Seal® Polyallomer	342413	13.5	16 x 76	342695
Quick-Seal Ultra-Clear™	344322	13.5	16 x 76	342695
Polyarbonate Bottle	355603	10.4	16 x 76	
Thinwall Polyallomer	326814	13.5	16 x 76	341968
Thickwall Polyallomer	355640	10.0	16 x 76	338907
Thickwall Polycarbonate	355630	10.0	16 x 76	338907
Ultra-Clear	344085	13.5	16 x 76	341968

Replacement Parts:

010018	O-ring for Rotor Handle
341965	Overspeed Disk, 80,000 rpm
341967	Rotor Handle
878073	O-ring for Rotor Lid
341964	Rotor Lid

Tubes, Caps & Replacement Parts for Discontinued Rotors

SW 30 Swinging-Bucket Rotor DISCONTINUED 1999

Recommended Replacement: SW 28

For use in instruments classified: B C D F G H R S

Tubes	P/N	Vol.	Size	Caps/ Spacer
Quick-Seal® Polyallomer	343664	15.0	25 x 38	355536
Quick-Seal konical™ Polyallomer	357345	8.5	25 x 38	355536
Thinwall Polyallomer	346599	20.0	25 x 50	
Thickwall Polyallomer	355658	17.5	25 x 50	
Thickwall Polycarbonate	355659	17.5	25 x 50	
Ultra-Clear™	346598	20.0	25 x 50	

Replacement Parts:

330334	Overspeed Disk, 30,000 rpm
331193	Overspeed Disk, 27,000 rpm
331186	Bucket Holder Rack
332400	Rotor Stand
346385	Bucket Assembly, Titanium, with Caps and O-rings, matched set of 6
812715	O-ring for Bucket
346587	Bucket Cap (each)

SW 30.1 Swinging-Bucket Rotor DISCONTINUED 1999

Recommended Replacement: SW 28.1

For use in instruments classified: B C D F G H R S

Tubes	P/N	Vol.	Size	Caps/ Spacer
Quick-Seal® Polyallomer	345830	6.3	16 x 45	355579
Thinwall Polyallomer	346601	8.0	16 x 51	
konical™ Polyallomer	358122	5.5	16 x 51	
Ultra-Clear™	346600	8.0	16 x 51	

Replacement Parts:

330334	Overspeed Disk, 30,000 rpm
331193	Overspeed Disk, 27,000 rpm
331186	Bucket Holder Rack
332400	Rotor Stand
815472	O-ring for Bucket
346588	Bucket Cap (each)

SW 50.1 Swinging-Bucket Rotor DISCONTINUED 1997

Recommended Replacement: SW 55 Ti

For use in instruments classified: A B C D F G H Q R S

Tubes	P/N	Vol.	Size	Caps/ Spacer
OptiSeal™ Polyallomer	361627	3.3	13 x 33	361678
Quick-Seal® Polyallomer	345829	2.0	13 x 25	355535
Quick-Seal konical™ Polyallomer	358647	3.2	13 x 51	355535
Thinwall Polyallomer	326819	5.0	13 x 51	
konical Polyallomer	358119	3.0	13 x 51	
Thickwall Polyallomer	349623	3.5	13 x 51	
Thickwall Polycarbonate	349622	3.5	13 x 51	
Ultra-Clear™	344057	5.0	13 x 51	

Replacement Parts:

330336	Overspeed Disk, 50,000 rpm
335458	Overspeed Disk, 45,000 rpm
331313	Bucket Holder Rack
332400	Rotor Stand
340081	Bucket Assembly, Titanium, with Caps, and O-rings, matched set of 6
824412	O-ring for Bucket

Z-60 Zonal Rotor, Titanium DISCONTINUED 1997

Recommended Replacement: Ti-14

For use in instruments classified: F G H S

Replacement Parts:

331155	Overspeed Disk, 60,000 rpm
335459	Overspeed Disk, 54,000 rpm
336576	Baffle. 4 required
	817035 O-ring, top of Core
	870525 O-ring, in Core Baffle
	4 required
824528	O-ring, top of Bushing in Coupling
829659	O-ring, bottom of Bushing in Coupling
834499	O-ring, bottom of Transfer Shaft
854540	O-ring, middle of Bushing in 0Coupling
870986	O-ring, for Rotor Lid

Tool Kit:

328917	Rotor Tool Kit
332688	Rotor Vise
332690	Spanner Wrench
333763	Tubing Removal Tool
858532	Pliers
337885	Baffle Alignment Tool



See also page 1-2 for factory installation.

Continuous Flow Rotor, Titanium

For use in instruments classified: **H S**

Major applications: Isopycnic banding of viruses.

Max. RPM	Max. g	k Factor	Rotor Capacity
32,000	102,000	42	430 mL

1

CF-32 Ti Rotor Kit

No. 350700 Basic Rotor Kit. Use with L5, L8, or Optima™

No. 350867 CF-32 Rotor (Rotor, Lid, O-ring)

CF-32 Ti Rotor Packages (for field installation of Optima/L8 instruments)

Include: Basic Rotor Kit, Door Kit, Adapter Bowl Assembly, and Vacuum Pump.

354438 CF-32 Rotor Package for Optima, 60 Hz

354439 CF-32 Rotor Package for Optima, 50 Hz

CF-32 Ti Accessories

354474 Door Kit and Hardware for Optima

L/XL Series

358921 Adapter Bowl, Optima/L8

358922 CF-32 Aspirator Vacuum Pump, 120 V

358923 CF-32 Aspirator Vacuum Pump, 220 V

961778 Vibration Mount, Optima (each; 3 needed)

355911 Vibration Mount, L/L2/L3/L5/L8 (set of 3)

354192 Standoff, CF-32 (sold in quantity of 1)

Note: A continuous-output gradient pump able to operate against a backpressure of 20 psi (138 kPa) is also required. The purchased pump must be able to provide a flow of up to 150 mL/min. (9 L/hr) and the pump head must accept 1/8-in. (3-mm) I.D. tubing. We recommend a Masterflex pump that can be purchased directly from the manufacturer:

Barnant Corporation
P.O. Box 510
Barrington, IL 60010
<http://www.barnant.com>

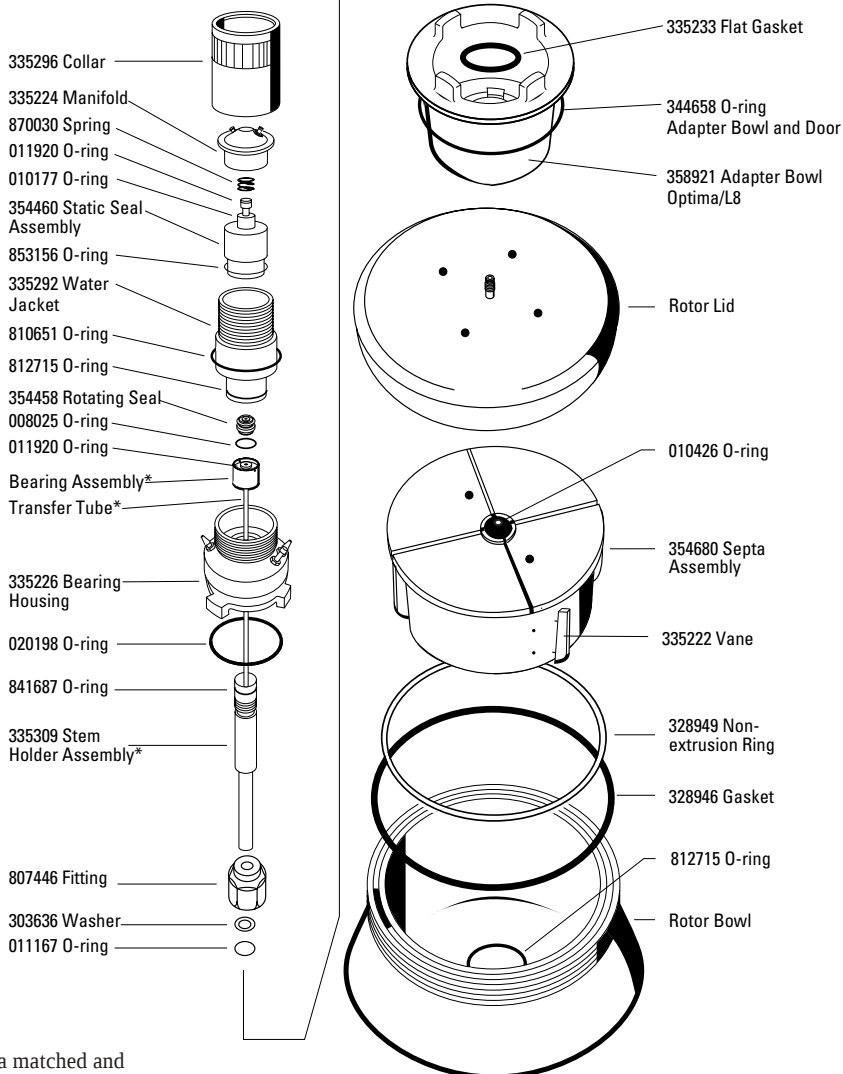
* Masterflex is a registered trademark of Cole-Parmer Instrument Company.

Rotor Replacement Parts

- 011167 O-ring for Stem Assembly
- 303636 Backup Washer (red fiber)
- 328946 Gasket for Rotor Lid
- 328949 Non-extrusion Ring
- 335222 Vane for Core
- 335303 Core Handle
- 335456 Overspeed Disk 32K
- 344658 Adapter Bowl O-ring
- 354680 Septa Assembly
- 807446 Fitting, Stainless Steel
- 841687 Small O-ring in Stem Assembly

Seal Assembly Replacement Parts

- 008025 O-ring under Rotating Seal (large)
- 010177 O-ring in Static Seal Assembly (medium)
- 011920 O-ring in Static Seal Assembly (small)
- 010426 O-ring in Rotating Seal (small)
- 020198 O-ring in Bearing Base
- 335233 Adapter Bowl Flat Gasket/Pad
- 354460 Static Seal Assembly
- 354458 Rotating Seal
- 853156 O-ring in Static Seal Assembly (large)
- 870030 Spring in Manifold
- 870315 O-ring in Manifold
- 354307 CF-32 Stem Assembly/Bearing Kit: Includes a matched and serialized set of Stem Holder Assembly and Bearing Assembly.



* Available only as part of Stem Assembly/Bearing Kit, P/N 354307.

Note: The CF-32 Ti Rotor cannot be used in Beckman Coulter ultracentrifuges that have been modified with the Prep UV-Scanner or Schlieren accessories.



Zonal Rotor, Titanium

For use in instruments classified: **H S**

Major applications: Rate-zonal centrifugation of subcellular particles.

Max. RPM	Max. g	Rotor Capacity	Typical Sample Volume	Particle Pathlength
32,000	102,000	1,675 mL	50-200 mL	7.5 cm

Note: Solutions in the pH range of 4 to 10 can be used in this Titanium rotor.

No. 969312 Type Ti-15 Titanium Zonal Rotor and Lid with Standard Core

No. 969313 Type Ti-15 Titanium Zonal Rotor and Lid with B29 Core

No. 369622 Type Ti-15 Titanium Zonal Rotor and Lid without Core

All above include 332676 Push-Pull Cap and Spare Parts/Supplies – 335148 Vacuum Grease, 306812 Spinkote™ Lubricant, 2 extra 335456 Overspeed Disks, and O-rings. (Seal Assembly, Mounting Hardware, and Tool Kit also required.)

Note: A continuous-output gradient pump able to operate against a backpressure of 20 psi (138 kPa) is also required. The purchased pump must be able to provide a flow of up to 50 mL/min. (3 L/hr) and the pump head must accept 1/8-in. (3-mm) I.D. tubing. We recommend a Masterflex pump that can be purchased directly from the manufacturer:

Barnant Corporation
P.O. Box 510
Barrington, IL 60010
<http://www.barnant.com>

* Masterflex is a registered trademark of Cole-Parmer Instrument Company.

Replacement Parts for the Ti-15 Rotor and the Discontinued Al-15 Rotor

328946	Rotor Gasket
328949	Non-extrusion Ring
332676	Push-Pull Cap
333857	Rotor Core, Noryl
	815472 O-ring, top of Rotor Core
	011167 O-ring for Seal Fitting
	812715 O-ring, bottom of Rotor Core
	332682 Cone
	011519 O-ring, interior of Cap
	332691 Seal Fitting
	012780 O-ring, visible, on Cap
335456	Ti-15 Overspeed Disk, 32,000 rpm
336821	Ti-15 Overspeed Disk, 29,000 rpm

Tool Kits/Additional Parts

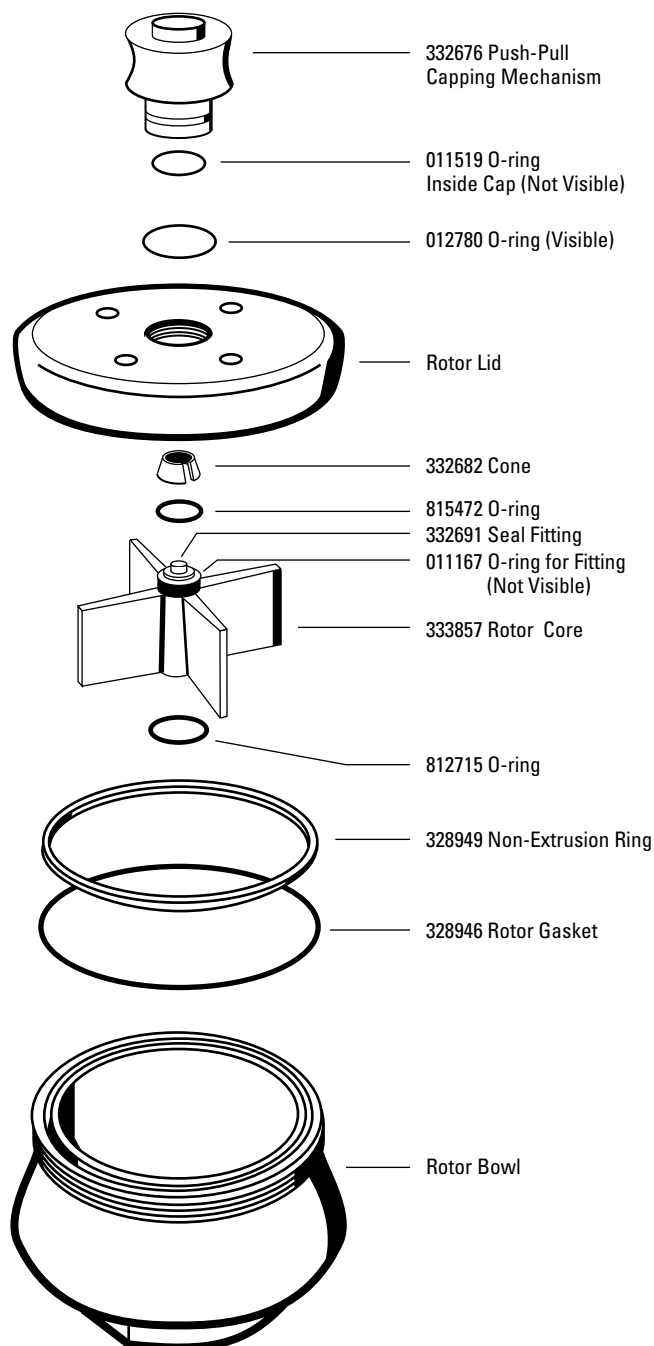
328917	Rotor Tool Kit	354192	Standoff (qty. 3 req'd for field installations)
332688	Rotor Vise		
332690	Spanner Wrench	961778	Vibe Mount (qty. 3 req'd for field installations)
333763	Tubing Removal Tool		
858532	Pliers		

B-29 Type Core for Al/Ti-15 Rotors

No. 350474. This core for introduction of sample solution and recovery of fractions from the edge as well as the center of the zonal rotor is readily interchangeable with the standard cores. The ability to load the zonal rotor from the edge can greatly facilitate flotation-type runs. Also isopycnic banding in cesium chloride can be economically extended to Titanium zonal rotors with the B-19 Type core.

Reograd Type Core

No. 350552. Gradient is loaded and unloaded while rotor is at rest. Gradient reorients during acceleration and reorients upon deceleration. Does not require zonal seal assembly or mounting hardware. The rotor is loaded using a special cap (supplied with the core) with inlet and outlet. The cap is replaced with the standard rotor cap for the run. This core is particularly useful for lipoprotein subfractionation.





Zonal Rotor, Titanium

For use in instruments classified: **H S**

Major applications: Rate-zonal centrifugation of subcellular particles, rate-zonal flotation of lipoproteins.

Max. RPM	Max. g	Rotor Capacity	Typical Sample Volume	Particle Pathlength
48,000	172,000	665 mL	20-50 mL	5.3 cm

Note: Solutions in the pH range of 4 to 10 can be used in this Titanium rotor.

No. 328911 Type Ti-14 Titanium Zonal Rotor and Lid with Noryl Core

No. 392048 Type Ti-14 Titanium Zonal Rotor and Lid without Core

All above include 332676 Push-Pull Cap and Spare Parts/Supplies – 335148 Vacuum Grease, 306812 Spinkote™ Lubricant, 2 extra 332619 Overspeed Disks, and O-rings. (Seal Assembly, Mounting Hardware, and Tool Kit also required.)

Note: A continuous-output gradient pump able to operate against a backpressure of 20 psi (138 kPa) is also required. The purchased pump must be able to provide a flow of up to 25 mL/min. (1.5 L/hr) and the pump head must accept 1/8-in. (3-mm) I.D. tubing. We recommend a Masterflex pump that can be purchased directly from the manufacturer:

Barnant Corporation
P.O. Box 510
Barrington, IL 60010
<http://www.barnant.com>

* Masterflex is a registered trademark of Cole-Parmer Instrument Company.

Replacement Parts for the Ti-14 Rotor and The Discontinued Al-14 Rotor

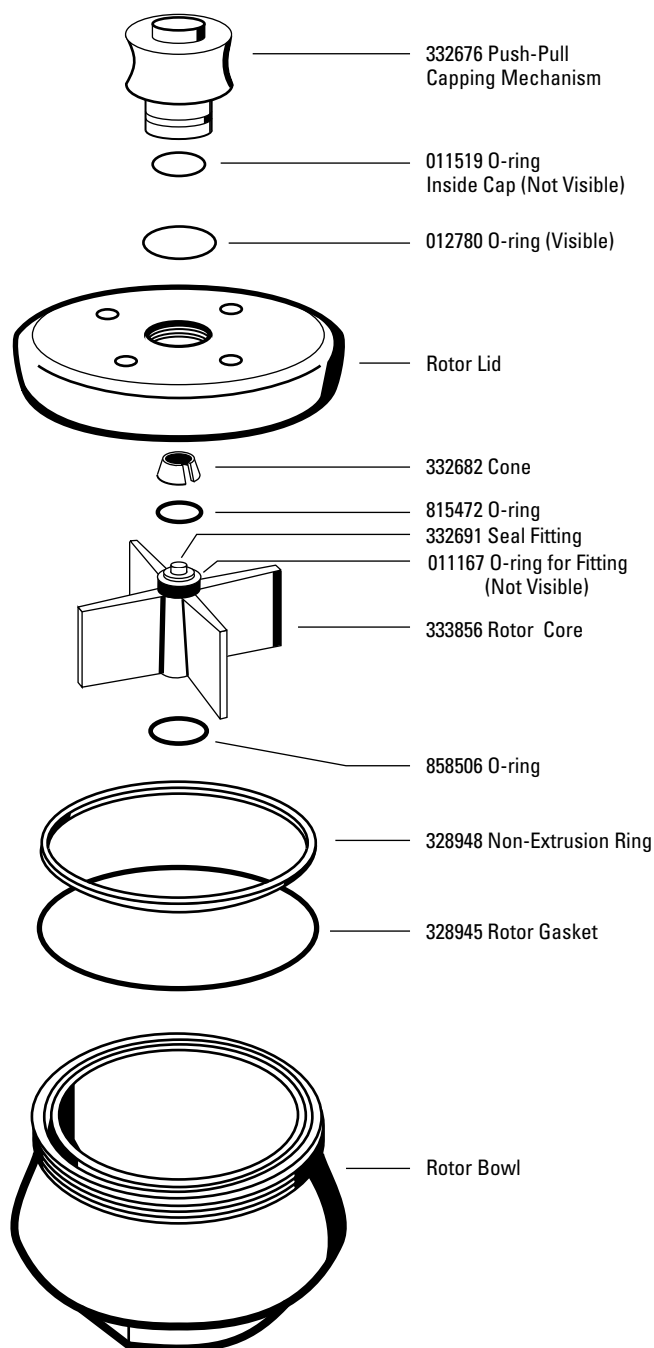
328945	Rotor Gasket
328948	Non-extrusion Ring
332676	Push-Pull Cap
332682	Cone
333856	Rotor Core, Noryl
	815472 O-ring, top of Rotor Core
	011167 O-ring for Seal Fitting
	858506 O-ring, bottom of Rotor Core
	332691 Seal Fitting
	011519 O-ring, interior of Cap
	012780 O-ring, visible, on Cap
330329	Ti-14 Overspeed Disk, 42,000 rpm
332619	Ti-14 Overspeed Disk, 48,000 rpm
332620	Ti-14 Overspeed Disk, 35,000 rpm

Tool Kits

328917	Rotor Tool Kit
332688	Rotor Vise
332690	Spanner Wrench
333763	Tubing Removal Tool
858532	Pliers

B-29 Type Core for Ti-14 Rotors

No. 350473. This core for introduction of sample solution and recovery of fractions from the edge as well as the center of the zonal rotor is readily interchangeable with the standard cores. The ability to load the zonal rotor from the edge can greatly facilitate flotation-type runs. Also, isopycnic banding in cesium chloride can be economically extended to Titanium zonal rotors with the B-29 Type Core.





For Zonal Rotors

For use in instruments classified: S

The Seal Assembly holds the lines through which fluids are introduced and withdrawn while the rotor is spinning at 2000 rpm. The assembly may be used with any of the Beckman Coulter zonal rotors in any Beckman Coulter preparative ultracentrifuge.

An order of a Seal Assembly should include three part numbers:

1. Seal Assembly, 334241
2. Tool Kit, 328917
3. Appropriate Mounting Hardware

If the Seal Assembly is to be used in more than one instrument, Mounting Hardware should be ordered for each instrument. If a Z-60 Rotor is to be run in an instrument in which the Ti-14 Rotor will be used, the 336830 Support Band Kit also should be ordered (no charge).

Important Reminder: Seal Assemblies for earlier zonal rotors cannot be used with the new rotors. To distinguish the new Seal Assembly from the earlier version, check the rotating and stationary seals; in the newer assembly, both seals are contained in a single unit, in the manifold assembly (see diagram).

Mounting Hardware

337890 Hardware for any L8M, L8, Optima™ XL

Optimas with Ti 15 rotors require each of the following parts:

- 345192 Standoff (quantity required: 3)
- 961778 Vibe Mount (quantity required: 3)

We recommend the Cole Parmer #7520-40 Pump with #7015-21 Pump Head which can be purchased directly from the manufacturer:

Barnant Corporation
P.O. Box 510
Barrington, IL 60010
Internet address: <http://www.barnant.com>

Installation Requirements

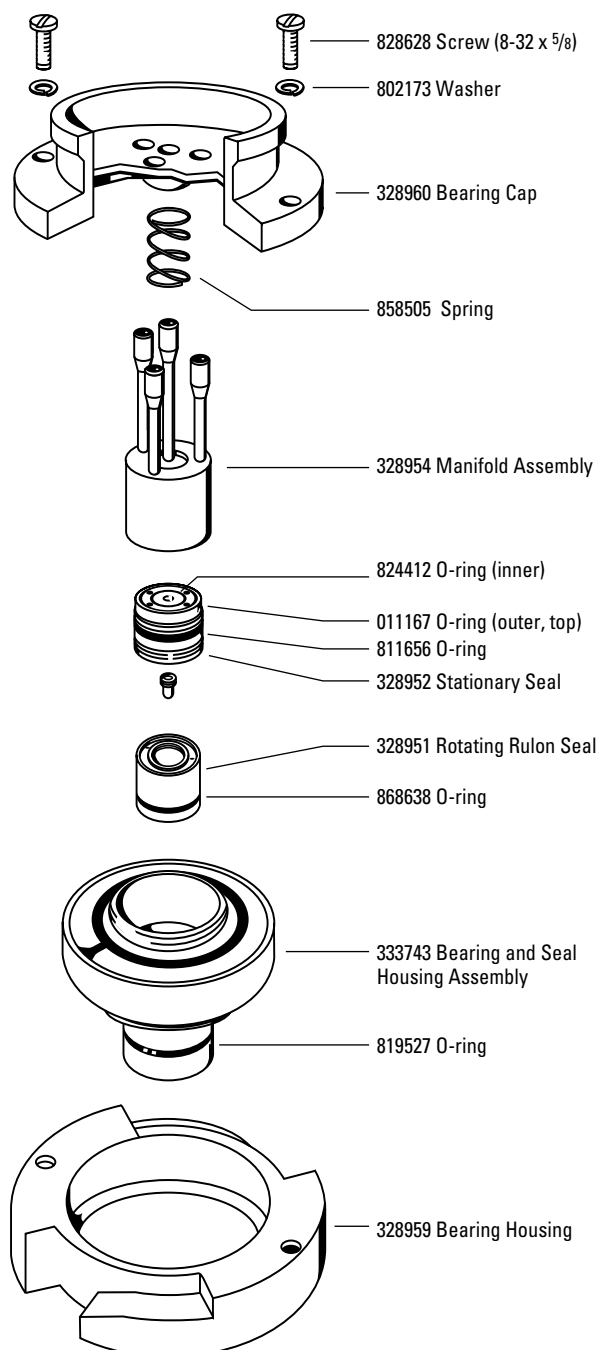
The Mounting Hardware will be installed by a Beckman Coulter Service Representative at no extra cost. In addition to the Gradient Pump, the following installation necessities not supplied by Beckman Coulter are needed: a syringe (50 or 100 mL) for introducing sample, and two hemostats or other clamping devices to shut off tubing lines when necessary.

Replacement Parts for Seal Assembly

- | | |
|--------|--|
| 011167 | O-ring, top of Stationary Seal |
| 328951 | Rotating Rulon Seal, for Seal Assembly |
| 328952 | Stationary Seal, two-piece construction |
| 332618 | Seal Disassembly Tool |
| 333743 | Bearing and Assembly |
| 802173 | Washer, for Bearing Cup |
| 811656 | O-ring, outer perimeter, Stationary Seal |
| 819527 | O-ring, for Bearing Assembly |
| 824412 | O-ring, center top of Stationary Seal |
| 828628 | Screw, for Bearing Cup |
| 868638 | O-ring, for Rotating Seal (set of 4) |
| 858505 | Spring, for Seal Assembly |
| 328954 | Manifold |

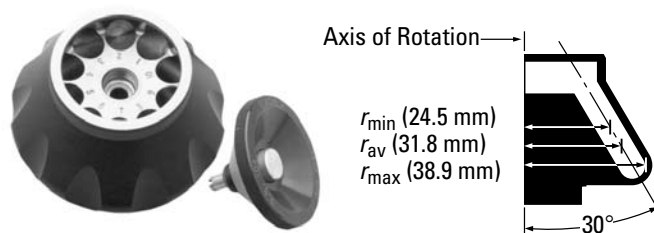
Tool Kits

- | | |
|--------|---------------------|
| 328917 | Rotor Tool Kit |
| 332688 | Rotor Vise |
| 332690 | Spanner Wrench |
| 333763 | Tubing Removal Tool |
| 858532 | Pliers |



Quick-Reference Guide to Rotor Specifications and Micro-Ultracentrifuge Compatibility

Rotor	Max. RPM	Max. g	k Factor	No. of Tubes x Nominal Tube Volume (mL)	Nominal Rotor Capacity (mL)	For Use in Instruments
TLA-120.2	120,000	627,000	16	10 x 2.0	20	TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuge, Optima MAX, Optima MAX-E
TLA-120.1	120,000	627,000	8	14 x 0.5	7	TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuge, Optima MAX, Optima MAX-E
TLA-110	110,000	657,000	13	8 x 5.1	40.8	TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuge, Optima MAX, Optima MAX-E
TLA-100.3	100,000	541,000	14	6 x 3.5	21	TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuge, Optima MAX, Optima MAX-E
TLA-100	100,000	436,000	7	20 x 0.2	4	TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuge, Optima MAX, Optima MAX-E
TLA-55	55,000	186,000	66	12 x 1.5	18	TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuge, Optima MAX, Optima MAX-E
TLS-55	55,000	259,000	50	4 x 2.2	8.8	TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuge, Optima MAX, Optima MAX-E
TLN-120	120,000	585,000	7	8 x 1.2	9.6	TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuge, Optima MAX, Optima MAX-E
TLN-100	100,000	450,000	14	8 x 3.9	31.2	TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuge, Optima MAX, Optima MAX-E
TLV-100	100,000	400,000	9	8 x 2.0	16	TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuge, Optima MAX, Optima MAX-E
MLA-130	130,000	1,019,000	8.7	10 x 2.0	20	Optima™ MAX, Optima MAX-E
MLA-80	80,000	444,000	29	8 x 8	64	Optima™ MAX, Optima MAX-E
MLS-50	50,000	268,000	71	4 x 5	20	Optima™ MAX, Optima MAX-E
MLN-80	80,000	389,000	20	8 x 8	64	Optima™ MAX, Optima MAX-E
A-110	110,000	199,000	9	6 x 180 µL	1,080 µL	Airfuge®
A-100/30	92,000	167,000	19	6 x 240 µL	1,440 µL	Airfuge
A-100/18	95,000	148,000	12	6 x 175 µL	1,050 µL	Airfuge
A-95	95,000	178,000	19	4 x 450 µL	1,800 µL	Airfuge
ACR-90	90,000	122,000	45	NA	3.5 mL	Airfuge
Batch Rotor	90,000	132,000	55	NA	7 mL	Airfuge
EM-90	90,000	118,000	NA	6 x 100 µL	600 µL	Airfuge

**Fixed-Angle Rotor, Titanium**

For use in the TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuges, and Optima MAX high-capacity personal micro-ultracentrifuges.

Note: Non-precipitating solutions up to 1.7 g/mL in density can be run in this rotor without a reduction in rotor speed.

Major applications: Pelletting of subcellular fractions in 5-30 minutes, plasmid DNA separation in 3 hours.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
120,000	627,000	16	10 × 2.0 mL 11 × 34 mm	20 mL

No. 362046. TLA-120.2 Fixed-Angle Rotor Assembly.

No. 357656. TLA-120.2 Fixed-Angle Rotor Package. Includes Rotor, 1 box 343778 Thickwall Polycarbonate Tubes, 348305 Tube Rack, 346133 Rotor Vise/Stand, 927208 Hemostats, 824412 and 854519 O-rings, 306812 Spinkote™ Lubricant, and 355148 Vacuum Grease.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol.(mL) g-Max	Size (mm)	Floating Spacers (qty. 1)	Adapters (qty. 1)	g-Force	k Factor	Max. Speed
Quick-Seal® Polyallomer	344625	50	2.0	11 × 32	344674	—	627,000	16	120,000
	344624	50	<i>1.5</i>	11 × 25	344636	—	627,000	14	120,000
Thickwall Polyallomer	347287	100	1.0	11 × 34	—	—	279,000	18	80,000
Thickwall Polycarbonate	343778	100	1.0	11 × 34	—	—	627,000	8	120,000

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Accessories

- 301875 Spacer Removal Tool
- 348305 Tube Rack for 11-mm Tubes (included with Rotor Package)
- 349487 Quick-Seal Tube Rack (Tube Rack Adapters required)
- 362100 Tube Rack Adapter (set/8) for sealing Tubes 344624
- 362101 Tube Rack Adapter (set/8) for sealing Tubes 344625
- 346133 Rotor Vise Assembly
- 349387 Tube Topper Rack for 11-mm Tubes
- 927208 Hemostats, 6-in. curved
- 345531 Quick-Seal Starter Kit, 11 × 25 mm, 2.0 mL Tubes.
Includes 10 each 344636 Spacers, box of 344624 Tubes
and 8 each Adapters. 349487 Tube Rack required.
- 345532 Quick-Seal Starter Kit, 11 × 32 mm, 2.0 mL Tubes.
Includes 10 each 344674 Spacers, box of 344625 Tubes
and 8 each 344644 Adapters. 349487 Tube Rack required.

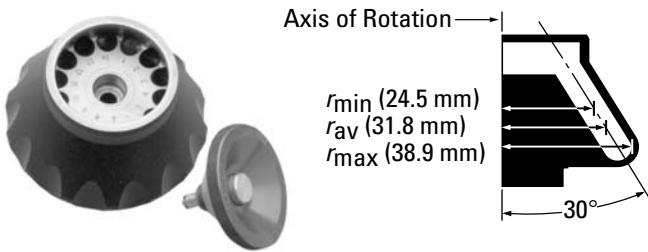
Rotor Replacements Parts

- 362048 Rotor Lid Assembly
- 854519 O-ring (outer, Rotor Lid)
- 824412 O-ring (inner, Rotor Lid)
- 349318 Cap & Plunger Assembly

Adapters/Spacers

344636 344674





Fixed-Angle Rotor, Titanium

For use in the TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuges, and Optima MAX high-capacity personal micro-ultracentrifuges.
Major applications: Pelleting of subcellular fractions in 5-30 minutes; plasmid DNA separation in 3 hours.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
120,000	627,000	8	14 x 0.5 mL 8 x 34 mm	7 mL

No. 362224. TLA-120.1 Fixed-Angle Rotor Assembly.
No. 357655. TLA-120.1 Fixed-Angle Rotor Package. Includes Rotor, 1 box 343776 Thickwall Polycarbonate Tubes, 348304 Tube Rack, 346133 Rotor Vise/Stand, 927208 Hemostats, 824412 and 854519 O-rings, 306812 Spinkote™ Lubricant, and 355148 Vacuum Grease.

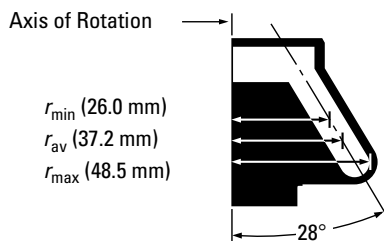
Tubes and Bottles									
Tube Style/Material	Part No.	Quantity	Vol.(mL)	Size g-Max	Floating (mm)	Adapters Spacers	g-Force	k Factor	Max. Speed
Thickwall Polyallomer	343777	100	0.5	8 x 34	—	—	279,000	18	80,000
Thickwall Polycarbonate	343776	100	0.5	8 x 34	—	—	627,000	8	120,000

Rotor Accessories

348305 Tube Rack for 8-mm Tubes (included with Rotor Package)
927208 Hemostats
346133 Rotor Vise/Stand
347404 Rotor Cleaning Brush

Rotor Replacement Parts

363335 Rotor Lid Assembly (O-rings not included)
854519 O-ring (outer, Rotor Lid)
824412 O-ring (inner, Rotor Lid)
349318 Cap & Plunger Assembly

**Fixed-Angle Rotor, Titanium**

For use in the TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuges, and Optima MAX Ultracentrifuges.

Major applications: Moderate volume differential sedimentation (pelleting) of subcellular organelles and viruses.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
110,000	657,000	13	8 x 5.1 mL 13 x 56 mm	40.8 mL

1

No. 366735. TLA-110 Fixed-Angle Rotor Package. Includes Rotor, one box of 361621 OptiSeal™ Tubes, eight each 361676 Floating Spacers, 854519 and 824412 O-ring, 348122 Rack Assembly, 927208 Hemostats, 306812 Spinkote™ Lubricant, and 335148 Vacuum Grease.

No. 366730. TLA-110 Fixed-Angle Rotor Assembly.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL) g-Max	Size (mm)	Floating Spacers (qty. 1)	Adapters (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal™ Polyallomer Bell Top	361621	56	4.7	13 x 48	361676	—	657,000	12	110,000
Quick-Seal® Polyallomer Bell Top	362248	50	5.1	13 x 51	362307	—	657,000	13	110,000
	349621	50	3.5	13 x 32	360270	—	657,000	7	110,000
	345829	50	2.0	13 x 25	360270	—	657,000	5	110,000
Thickwall Polyallomer	362333	50	3.2	13 x 56	—	—	267,000	37	70,000
Thickwall Polycarbonate	362305	50	3.2	13 x 56	—	—	657,000	13	110,000
Microcentrifuge Polyallomer	357448	500	1.5	11 x 39	—	360951	206,000	19	70,000

* Package of eight.

Rotor Accessories

338765 Spacer Removal Tool for 3.5-mL and 2.0-mL Quick-Seal Tube Spacers
 355872 Tube Rack for 13-mm Tubes (included in Rotor Package)
 348122 Tube Topper Rack for 13-mm Tubes
 349487 Tube Rack for g-Max® Quick-Seal Tubes
 355582 Tube Rack Adapter for 13 x 32 mm, 3.5-mL Quick-Seal Tubes for use in 349487 Tube Rack
 345832 Tube Rack Adapter for 13 x 25 mm, 2.0-mL Quick-Seal Tubes for use in 349487 Tube Rack
 347404 Rotor Cleaning Brush
 927208 Hemostats, 6-in. curved

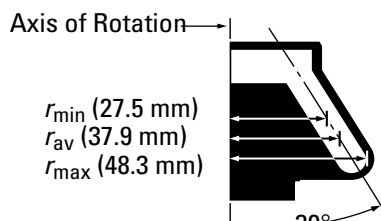
Rotor Replacement Parts

854519 O-ring (outer, Rotor Lid)
 824412 O-ring (inner, Rotor Lid)
 349477 Cap & Plunger Assembly

Adapters/Spacers

360270 360951 361676 362307



**Fixed-Angle Rotor, Titanium**

For use in the TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuges, and Optima MAX high-capacity personal micro-ultracentrifuges.

Note: Non-precipitating solutions up to 1.7 g/mL in density can be run in this rotor without a reduction in rotor speed.

Major applications: Pelleting of subcellular fractions in 5-30 minutes; pelleting RNA in 1-2 hours; plasmid DNA separation in 6 hours.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
100,000	541,000	14	6 × 3.5 mL 13 × 51 mm	21 mL

No. 349481. TLA-100.3 Fixed-Angle Rotor Assembly.

No. 349490. TLA-100.3 Fixed-Angle Rotor Package. Includes Rotor, 1 box 349622 Thickwall Polycarbonate Tubes, 1 box 349623 Thickwall Polyallomer Tubes, 1 each 355919 pkg. of 6 Spacers for 1.5 mL Microcentrifuge Tubes, 355872 Tube Rack, 824412 and 854521 O-rings, 927208 Hemostats, 346133 Rotor Vise/Stand, 306812 Spinkote™ Lubricant, and 335148 Vacuum Grease.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL)	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k Factor	Max. Speed
Quick-Seal® Polyallomer	349621	50	3.5	13 × 32	355937	—	541,000	14	100,000
	345829	50	2.0	13 × 25	360270	—	541,000	11	100,000
Thickwall Polyallomer	349623	25	3.0	13 × 51	—	—	265,000	34	70,000
Thickwall Polycarbonate	349622	25	3.0	13 × 51	—	—	541,000	16	100,000
Microcentrifuge Polyallomer	357448	500	1.5	11 × 38	—	355919	245,000	24	70,000

Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.

Rotor Accessories

338765 Spacer Removal Tool for 3.5-mL and 2.0-mL Quick-Seal Tube Spacers
 355872 Tube Rack for 13-mm Tubes (included in Rotor Package)
 348122 Tube Topper Rack for 13-mm Tubes
 349487 Tube Rack for Quick-Seal Tube Sealer, 8-place (Adapters required)
 355582 Tube Rack Adapter for 13 × 32 mm, 3.5-mL Quick-Seal Tubes for use in 349487 Tube Rack
 345832 Tube Rack Adapter for 13 × 25 mm, 2.0-mL Quick-Seal Tubes for use in 349487 Tube Rack
 347404 Rotor Cleaning Brush

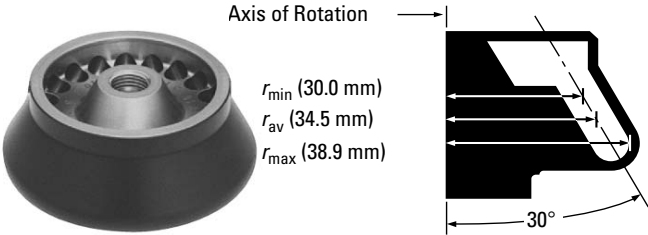
Rotor Replacement Parts

349478 Rotor Lid Assembly
 354443 CentriTube Slicer Adapter for 13-mm Tubes
 854521 O-ring (outer, Rotor Lid)
 824412 O-ring (inner, Rotor Lid)
 349477 Cap & Plunger Assembly

Adapters/Spacers

355919 355937 360270





Fixed-Angle Rotor, Titanium

For use in the TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuges, and Optima MAX high-capacity personal micro-ultracentrifuges.

Note: Non-precipitating solutions up to 1.7 g/mL in density can be run in this rotor without a reduction in rotor speed.

Major applications: Pelleting of subcellular fractions; proteins; RNA.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
100,000	436,000	7	20 x 0.2 mL 7 x 20 mm	4 mL

- No. 343840. TLA-100 Fixed-Angle Rotor Assembly.
- No. 343837. TLA-100 Fixed-Angle Rotor Package. Includes Rotor, 1 box 343775 Thickwall Polycarbonate Tubes, 348302 Tube Rack, 824412 and 824953 O-rings, 927208 Hemostats, 346133 Rotor Vise/Stand, 306812 Spinkote™ Lubricant, and 335148 Vacuum Grease.

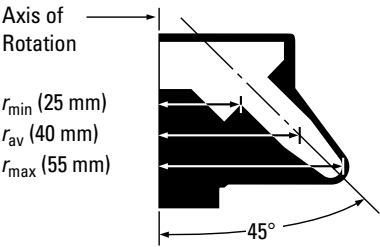
Tubes and Bottles									
Tube Style/Material	Part No.	Quantity	Vol.(mL)	Size g-Max	Floating (mm)	Adapters Spacers (qty. 1)	g-Force (qty. 1)	k Factor	Max. Speed
Thickwall Polyallomer	343621	100	0.2	7 x 20	—	—	279,000	10	80,000
Thickwall Polycarbonate	343775	100	0.2	7 x 20	—	—	436,000	7	100,000
Thickwall Cellulose Propionate	342303	100	0.2	7 x 20	—	—	184,000	16	65,000

Rotor Accessories

- 348302 Tube Rack for 7-mm Tubes (included with Rotor Package)
- 927208 Hemostats, 6-in. curved
- 347404 Rotor Cleaning Brush
- 346133 Rotor Vise/Stand

Rotor Replacement Parts

- 824953 O-ring (outer, Rotor Lid)
- 824412 O-ring (inner, Rotor Lid)
- 343845 Rotor Lid Assembly (O-rings not included)
- 349318 Cap & Plunger Assembly



Fixed-Angle Rotor, Aluminum

For use in the TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuges, and Optima MAX Ultracentrifuges.
Major applications: Rapid pelleting of nucleic acid precipitates in 1.5 mL tubes.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
55,000	186,000	66	12 x 1.5 mL 11 x 38 mm	18 mL

No. 366725. TLA-55 Fixed-Angle Rotor Package. Includes Rotor, one box of 500 each 357448 Tubes, 824412 and 824644 O-ring, 348122 Rack Assembly, 927208 Hemostats, 306812 Spinkote™ Lubricant and 335148 Vacuum Grease.

No. 366720. TLA-55 Fixed-Angle Rotor Assembly.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL)	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters* (qty. 1)	g-Force	k factor	Max. Speed
Microcentrifuge Polyallomer	357448	500	1.5	11 x 39	—	—	186,000	66	55,000

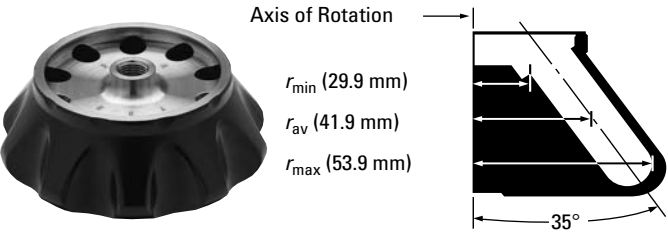
*Package of eight.

Rotor Accessories

347404 Rotor Cleaning Brush

Rotor Replacement Parts

366722 Rotor Lid Assembly
824644 O-ring (Outer, Rotor Lid)
824412 O-ring (Inner, Rotor Lid)
349318 Cap & Plunger Assembly



Fixed-Angle Rotor, Titanium

For use in the Optima™ MAX Ultracentrifuges.
Major applications: Rapid differential sedimentation (pelleting) of small particles such as subcellular organelles and viruses.

Max. RPM	Max. g	k Factor	Number of Tubes	Rotor Capacity Volume/Size
130,000	1,019,000	8.7	10 x 2.0 mL 11 x 32 mm	20 mL

No. 367114. MLA-130 Fixed-Angle Rotor Package. Includes Rotor, one box of 50 each 344625 Polyallomer Quick-Seal® Tubes, 367310 Spacer, 348305 Tube Rack, 975001 O-ring, 927208 Hemostats, 306812 Spinkote™ Lubricant and 335148 Vacuum Grease.

No. 367120. MLA-130 Fixed-Angle Rotor Assembly.

Rotor Replacement Parts

346133 Rotor Vise

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL)	Size (mm)	Floating Spacers (qty. 1)	Adapters (qty. 1)	g-Force	k factor	Max. Speed
Quick-Seal® Polyallomer	344625	50	2.0	11 x 32	367310	—	1,019,000	8.7	130,000
	344624	50	1.5	11 x 25	367310	—	1,019,000	7.0	130,000
Thickwall Polyallomer	347287	100	1.0	11 x 34	—	—	390,000	23	80,000
Thickwall Polycarbonate	343778	50	1.0	11 x 34	—	—	1,019,000	5.8	130,000

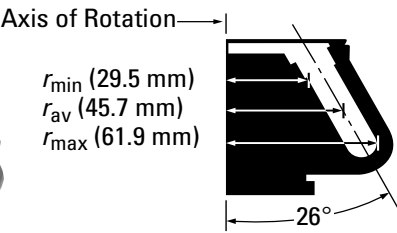
Rotor Replacement Parts

367116 Rotor Lid
975001 O-ring for Lid

Adapters/Spacers

367310





Fixed-Angle Rotor, Titanium

For use in instruments classified: **Optima™ MAX High-Capacity Personal Micro-Ultracentrifuges**.
Major applications: Large volume differential sedimentation (pelleting) of subcellular organelles and viruses.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
80,000	444,000	29	8 x 8 mL 16 x 64 mm	64 mL

No. 367096. MLA-80 Fixed-Angle Rotor Package. Includes Rotor, one box of 50 each 344621 Tubes, 367094 Quick-Seal® Bell Top Spacer, 892292 O-ring, 348123 Tube Rack, 927208 Hemostats, 338765 Stem Lifter, 306812 Spinkote™ Lubricant and 335148 Vacuum Grease.
No. 367087. MLA-80 Fixed-Angle Rotor Assembly.

Rotor Replacement Parts

892292 O-ring

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL)	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k factor	Max. Speed
Quick-Seal® Polyallomer	344621	50	8.0	16 x 58	367094	_____	444,000	29	80,000
	345830	50	6.3	16 x 45	367094	_____	444,000	23	80,000
	356562	50	4.2	16 x 38	367094	_____	444,000	18	80,000
Thickwall Polyallomer	355646	25	6.5	16 x 64		_____	84,900	153	35,000
Thickwall Polycarbonate	355647	25	6.5	16 x 64		_____	417,000	19	80,000

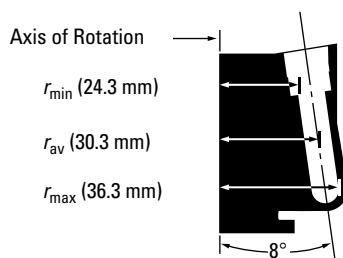
Rotor Replacement Parts

367089 Rotor Lid

Adapters/Spacers

367094



**NVT™ Near-Vertical Rotor, Titanium**

For use in the TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuges, and Optima MAX high-capacity personal micro-ultracentrifuges.

Note: Non-precipitating solutions up to 1.7 g/mL in density can be run in this rotor without a reduction in rotor speed.

Major applications: Plasmid DNA Separations in 1½ hours.**

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
120,000	585,000	7	8 × 1.2 mL 8 × 35 mm	9.6 mL

No. 357683. TLN-120 Near-Vertical Package. Includes Rotor, 1 box 361082 Quick-Seal® Polyallomer Tubes, 347402 Foam Vise Tape, 348302 Quick-Seal Tube Rack, 347373 Rotor Vise, 306812 Spinkote™ Lubricant, 12 each 347371 Plug Gaskets, 10 each 361061 Spacers, 976959 Torx Plug Adapter, 858121 Torque Wrench, and 927208 Hemostat.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL)	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k factor	Max. Speed
Quick-Seal Polyallomer	361082	50	1.2	8 × 35	361061	—	585,000	7	120,000

*To accommodate the TLN-120 Rotor, the TL-100 ultracentrifuge must be updated with a new drive spindle and operating software (modification kit number 360477).

**Using Optima TLX.

Rotor Accessories

345529 Quick-Seal Tube Sealing Kit (60 Hz, 120 V sealer)
 348302 Quick-Seal Tube Sealing Rack
 358312 Quick-Seal Cordless Tube Topper Kit, 60 Hz
 358313 Quick-Seal Cordless Tube Topper Kit, 50 Hz (Europe)
 358314 Quick-Seal Cordless Tube Topper Kit, 50 Hz (Great Britain)
 358315 Quick-Seal Cordless Tube Topper Kit, 50 Hz (Australia)
 348304 Tube Topper Rack, 8 mm
 858121 Torque Wrench
 347960 CentriTube Slicer
 348299 CentriTube Slicer Replacement Blades (pkg of 10)
 338765 Tube Removal Tool
 927208 Hemostat (6-in., curved)
 306812 Spinkote Lubricant
 347402 Rotor Vise Mounting Tape (replacement)
 347404 Rotor Cleaning Brush
 339555 Beckman Coulter Solution 555™

Rotor Replacement Parts**For Rotors Manufactured Prior to 1/2000**

347369 Rotor Plug† (does not include gasket)
 347371 Rotor Plug Gasket
 347373 Rotor Vise
 347372 Hex-plug Adapter
 349339 Cap and Plunger Assembly

For Rotors Manufactured After 1/2000

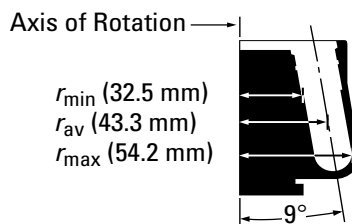
368549 Rotor Plug Replacement (each)
 368550 Rotor Plug Assembly Replacement (includes gasket, set of 8)
 347371 Rotor Plug Gasket
 347373 Rotor Vise
 349339 Cap and Plunger Assembly
 976959 Torx Adapter

† If replacing all rotor plugs, use Torx style, P/N 368550.

Adapters/Spacers

361061



**NVT™ Near-Vertical Rotor, Titanium**

For use in the TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuges, and Optima MAX high-capacity personal micro-ultracentrifuges.

Note: Non-precipitating solutions up to 1.7 g/mL in density can be run in this rotor without a reduction in rotor speed.

Major applications: Plasmid DNA-Separations in 4 hours.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
100,000	450,000	14	8 × 3.9 mL 13 × 38 mm	31.2 mL

No. 357614. TLN-100 Near-Vertical Rotor Package. Includes Rotor, OptiSeal™ Kit (includes 4 boxes 361627 Tubes, 8 each 362198 Spacers, 361650 OptiSeal Tube Rack, and 361668 Tube Extraction Tool), 347373 Rotor Vise, 306812 Spinkote™ Lubricant, 335148 Vacuum Grease, 12 each 342882 Sealing Washers, 976959 Torx Plug-wrench Adapter, 858121 Torque Wrench, and 927108 Hemostat.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL)	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k factor	Max. Speed
OptiSeal Polyallomer	361627	56	3.3	13 × 33	362198	—	450,000	14	100,000
Quick-Seal Polyallomer	358980	50	3.9	13 × 38	342883	—	450,000	14	100,000

Rotor Accessories

338765 Tube Removal Tool
342883 Quick-Seal Tube Spacer
348122 Tube Topper Rack
858121 Torque Wrench
927208 Hemostats, 6-in. curved

Rotor Replacement Parts**For Rotors Manufactured Prior to 1/2000**

342881 Rotor Plug† (gasket not included)
342882 Rotor Plug Gasket
347373 Rotor Vise
347402 Rotor Vise Mounting Tape (replacement)
349339 Cap and Plunger Assembly

For Rotors Manufactured After 1/2000

368546 Rotor Replacement Plug (set of 8)
368545 Rotor Replacement Plug (single)
342882 Rotor Plug Gasket
347373 Rotor Vise
347402 Rotor Vise Mounting Tape (replacement)
349339 Cap and Plunger Assembly
976959 Torx Adapter

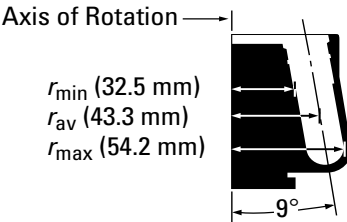
† This part number is no longer available. If replacing all rotor plugs, use Torx style, P/N 368545.

Adapters/Spacers

342883

362198





Near-Vertical Tube Rotor, Titanium

For use in the Optima™ MAX Ultracentrifuges.
Major applications: Rapid contamination-free isopycnic isolation of plasmid DNA.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
80,000	389,000	20	8 x 8 mL 16 x 58 mm	64 mL

No. 367100. MLN-80 Near-Vertical Tube Rotor Package. Includes Rotor, one box of 50 each 344621 Tubes, 367101 Spacer, 348123 Tube Rack, 347373 Vise, 355875 Plug and Cell, 349290 Washer and Plug, 927208 Hemostats, 338765 Stem Lifter, 306812 Spinkote™ Lubricant and 335148 Vacuum Grease, 976595 Torx Wrench Adapter.

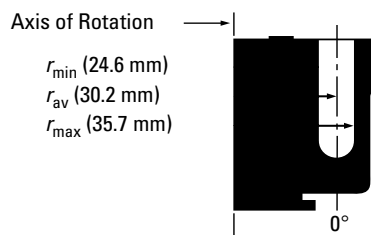
No. 367099. MLN-80 Near-Vertical Tube Rotor Assembly.

Tubes and Bottles									
Tube Style/Material	Part No.	Quantity	Vol. (mL)	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k factor	Max. Speed
Quick-Seal® Polyallomer	344621	50	8.0	16 x 58	367101	—	390,000	20	80,000
	345830	50	6.3	16 x 45	349289 367313	—	390,000	18	80,000
	356562	50	4.2	16 x 38	349289 367312	—	390,000	16	80,000

Rotor Replacement Parts

355875 Plug, Cell
349290 Washer, Seal
356306 Torx Wrench Adapter

Adapters/Spacers				
349289	367101	367312	367313	

**Vertical-Tube Rotor, Titanium**

For use in the TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuges, and Optima MAX high-capacity personal micro-ultracentrifuges.

Note: Non-precipitating solutions up to 1.7 g/mL in density can be run in this rotor without a reduction in rotor speed.

Major application: Plasmid DNA-separations in 4 hours.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
100,000	400,000	9	8 x 2.0 mL 11 x 32 mm	16 mL

No. 347375. TLV-100 Rotor Package. Includes 347374 Rotor, Spinkote™ Lubricant, Removal Tool, Washers, Wrench Assembly, Torque Wrench, Vise and Tape, box of 344625 Tubes, 349487 Quick-Seal® Tube Rack, Adapters, and Spacers.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL)	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k factor	Max. Speed
Quick-Seal Polyallomer	344625	50	2.0	11 x 32	347370	—	400,000	9	100,000

Rotor Accessories

349487 Tube Rack for 11-mm Tubes (included with Rotor Package)
 362101 Tube Rack Adapter for sealing 11 x 32 mm Tubes in
 Tube Rack 349487
 347373 Rotor Vise
 347402 Foam Vise Mounting Tape
 347404 Rotor Cleaning Brush
 858121 Torque Wrench
 927208 Hemostats

Rotor Replacement Parts**For Rotors Manufactured Prior to 1/2000**

347369 Rotor Plug† (does not include gasket)
 347371 Rotor Plug Gasket
 347370 Quick-Seal Tube Spacers
 347372 Hex-plug Adapter for Torque Wrench
 349339 Cap and Plunger Assembly

For Rotors Manufactured After 1/2000

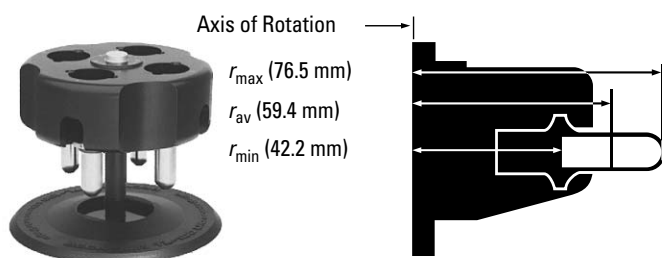
368549 Rotor Plug Replacement (each)
 368550 Rotor Plug Assembly Replacement (includes gasket, set of 8)
 347371 Rotor Plug Gasket
 347370 Quick-Seal Tube Spacers
 349339 Cap and Plunger Assembly
 976959 Torx Adapter

† If replacing all rotor plugs, use Torx style, P/N 368550.

Adapters/Spacers

347370





Swinging-Bucket Rotor, Titanium

For use in the TL-100, Optima™ TL, Optima TLX personal micro-ultracentrifuges, and Optima MAX high-capacity personal micro-ultracentrifuges.

Note: Non-precipitating solutions up to 1.7 g/mL in density can be run in this rotor without a reduction in rotor speed.

Major applications: RNA pelleting in 2-3 hours; subcellular fractionation in sucrose gradients, protein separations in sucrose gradients.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
55,000	259,000	50	4 x 2.2 mL 11 x 34 mm	8.8 mL

No. 346936. TLS-55 Swinging-Bucket Rotor Assembly with 4 Titanium Buckets.

No. 346134. TLS-55 Swinging-Bucket Rotor Package. Includes Rotor, 348305 Tube Rack, 1 Box of 347357 Polyallomer Tubes, 868638 Set of 4 O-rings, 927208 Hemostats, 347358 Bucket Holder Rack, 335148 Vacuum Grease, and 306812 Spinkote™ Lubricant.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Vol. (mL)	Size (mm)	Required Caps/ Spacers (qty. 1)	Required Adapters (qty. 1)	g-Force	k factor	Max. Speed
Quick-Seal® Polyallomer	344625	50	2.0	11 x 32	344674	_____	259,000	50	55,000
	344624	50	1.5	11 x 25	344674	_____	259,000	37	55,000
Thinwall Polyallomer	347357	50	2.2	11 x 34	_____	_____	259,000	50	55,000
	342630	100	175 µL	5 x 20	_____	358614	248,000	22	55,000
Thickwall Polyallomer	347287	100	1.4	11 x 34	_____	_____	259,000	50	55,000
Thickwall Polycarbonate	343778	100	1.4	11 x 34	_____	_____	259,000	50	55,000
	343775	100	230 µL	7 x 20	_____	358615	249,000	23	55,000
Thinwall Cellulose Propionate	342630	100	175 µL	5 x 20	_____	358614	248,000	22	55,000
Thickwall Cellulose Propionate	342303	100	230 µL	7 x 20	_____	358615	249,000	23	55,000
Thickwall Polyethylene	343622	100	175 µL	5 x 20	_____	358614	248,000	22	55,000
Thinwall Ultra-Clear	347356	50	2.2	11 x 34	_____	_____	259,000	50	55,000

Rotor Accessories

348305 Tube Rack for 11-mm Tubes (included with Rotor Package)
 349487 Quick-Seal Tube Rack (Tube Rack Adapters required)
 362100 Tube Rack Adapters, set/8, for 344624 11 x 25 mm Quick-Seal Tubes
 362101 Tube Rack Adapters, set/8, for 344625 11 x 25 mm Quick-Seal Tubes
 349387 Tube Topper Rack for 11-mm Tubes
 927208 Hemostats, 6-in. curved
 347404 Rotor Cleaning Brush

Rotor Replacement Parts

345773 Rotor Stand
 346364 Replacement Bucket Set, set of 4
 868638 Bucket O-ring, set of 4
 345770 Bucket Cap Assembly (each)
 347358 Bucket Stand
 349338 Cap & Plunger Assembly

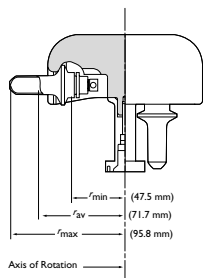
Adapters/Spacers

344674

358614

358615



**Swinging-Bucket Rotor, Aluminum**

For use in the Optima™ MAX Ultracentrifuges.

Major applications: Rate-zonal separations of subcellular organelles, pelleting and isopycnic separations of RNA.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
50,000	268,000	71	4 x 5 mL 13 x 51 mm	20 mL

No. 367280. MLS-50 Swinging-Bucket Rotor Package. Includes Rotor, one box of 326819 Polyallomer Tubes, 331313 Rack Assembly, 824412 O-ring, 927208 Hemostats, 306812 Spinkote™ Lubricant and 335148 Vacuum Grease.

No. 367279. MLS-50 Swinging-Bucket Rotor Assembly.

Tubes

Tube Style/Material	Part No.	Quantity	Vol. (mL)	Size (mm)	Floating Spacers (qty. 1)	Adapters (qty. 1)	g-Force	k Factor	Max. Speed
OptiSeal™ Polyallomer	361627	50	3.3	13 x 33	361678*	—	268,000	42	50,000
Quick-Seal® Polyallomer	345829	50	2.0	13 x 25	355535	—	268,000	29	50,000
Quick-Seal konical™ Polyallomer	358647	50	3.2	13 x 51	355535	358153**	262,000	67	50,000
Polyallomer	326819	50	5.0	13 x 51	—	—	268,000	71	50,000
konical Polyallomer	358119	50	3.0	13 x 51	—	358153**	262,000	67	50,000
Thickwall Polyallomer	349623	25	3.5	13 x 51	—	—	268,000	71	50,000
Thickwall Polycarbonate	349622	25	3.5	13 x 51	—	—	268,000	71	50,000
Ultra-Clear	344057	50	5.0	13 x 51	—	—	268,000	71	50,000
	344090	50	0.8	5 x 41	—	356860	218,000	67	46,000

* Package of two.

** Package of six.

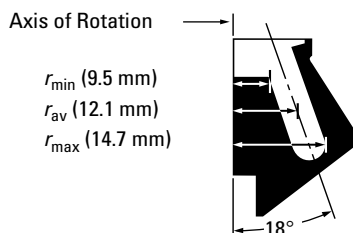
Rotor Replacement Parts

367278 Rotor Stand Assembly
367284 Bucket Set
367285 Bucket Cap
824412 O-ring

Adapters/Spacers

355535 356860 358153 361678



**Fixed-Angle Rotor, Aluminum, Red**

For use in the Airfuge® Air-Driven Micro-Ultracentrifuge.

Major application: Fast pelleting of very small samples.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
110,000	199,000	9	6 × 180 µL 5 × 20 mm	1,080 µL

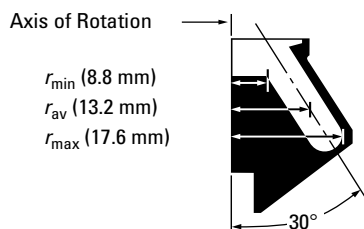
No. 347596. A-110 Rotor. Fixed-Angle Rotor with 18° angle, aluminum, anodized red. Includes 1 box of 342630 polyallomer tubes.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Usable Volume	Size (µL)	g-Force (mm)	k Factor	Max. Speed
Open-Top Tubes							
Polyallomer	342630	100	175	5 × 20	199,000	9	110,000
Polyethylene	343622	100	175	5 × 20	199,000	9	110,000
Ultra-Clear™	344718	100	180	5 × 20	199,000	9	110,000

Rotor Supplies

339643 Rotor Caps, polyethylene, package of 20
 348301 Tube Rack for 5-mm diameter Tubes
 343773 Tube Cap Strip, 6-place, package of 50
 339639 Rotor Base Bushing, white
 341252 Rotor Stand/Vise

**Fixed-Angle Rotor, Aluminum, Blue**

For use in Airfuge® Air-Driven Micro-Ultracentrifuge.

Major application: Fast pelleting of very small samples.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
92,000	167,000	19	6 × 240 µL 5 × 20 mm	1,440 µL

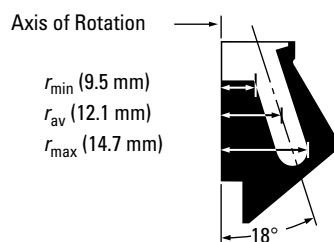
No. 347594. A-100/30 Rotor. Fixed-Angle Rotor with 30° angle, anodized blue. Includes 1 box of 342630 Polyallomer Tubes.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Usable Volume	Size (µL)	g-Force (mm)	k Factor	Max. Speed
Open-Top Tubes							
Polyallomer	342630	100	220	5 × 20	167,000	19	92,000
Polyethylene	343622	100	150	5 × 20	167,000	19	92,000
Ultra-Clear™	344718	100	240	5 × 20	167,000	19	92,000

Rotor Supplies

339643 Rotor Caps, polyethylene, package of 20
 348301 Tube Rack for 5-mm diameter Tubes
 343773 Tube Cap Strip, 6-place, package of 50
 341252 Rotor Stand/Vise

**Fixed-Angle Rotor, Aluminum, Silver**

For use in the Airfuge Air-Driven Micro-Ultracentrifuge.

Major application: Fast pelleting of very small samples.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
95,000	148,000	12	6 × 175 µL 5 × 20 mm	1,050 µL

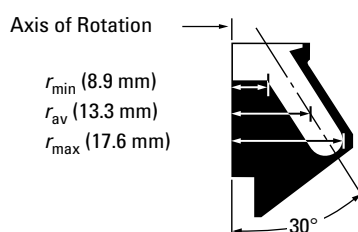
No. 347593. A-100/18 Rotor. Fixed-Angle Rotor with 18° angle, aluminum, anodized silver. Includes 1 box of 342630 Polyallomer Tubes.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Usable Volume (µL)	Size (mm)	g-Force	k Factor	Max. Speed
Open-Top Tubes							
Polyallomer	342630	100	175	5 × 20	148,000	12	95,000
Polyethylene	343622	100	100	5 × 20	148,000	12	95,000
Ultra-Clear	344718	100	175	5 × 20	148,000	12	95,000

Rotor Supplies

339643 Rotor Caps, polyethylene, package of 20
 348301 Tube Rack for 5-mm diameter tubes
 343773 Tube Cap Strip, 6-place, package of 50
 339639 Rotor Base Bushing, white
 341252 Rotor Stand/Vise

**Fixed-Angle Rotor, Aluminum, Black**

For use in Airfuge Air-Driven Micro-Ultracentrifuge.

Major application: Fast pelleting of very small samples.

Max. RPM	Max. g	k Factor	Number of Tubes Volume/Size	Rotor Capacity
95,000	178,000	19	4 × 450 µL 8 × 20 mm	1,800 µL

No. 347595. A-95 Rotor. Fixed-Angle Rotor with 30° angle, aluminum, anodized black. Includes 1 box of 345843 Ultra-Clear™ Tubes.

Tubes and Bottles

Tube Style/Material	Part No.	Quantity	Usable Volume	Size (µL)	g-Force (mm)	k Factor	Max. Speed
Open-Top Tubes							
Ultra-Clear	345843	100	450	8 × 20	178,000	19	95,000

Rotor Supplies

339643 Rotor Caps, polyethylene, package of 20
 348304 Tube Rack for 8-mm diameter Tubes
 343773 Tube Cap Strip, 6-place, package of 50
 339639 Rotor Base Bushing, white
 341252 Rotor Stand/Vise

ACR-90

3.5 mL/2.4 mL



ACR-90 Chylomicron Rotor, Silver

For use in the Airfuge Air-Driven Micro-Ultracentrifuge.

Major application: Rapid clarification of lipemic blood samples.

Max. RPM	Max. g	k Factor	Rotor Capacity Volume/Size	Yield (mL)
90,000	122,000	45	3.5 mL	2.6
90,000	107,000	39	2.4 mL	1.4

1

No. 341260. ACR-90 Chylomicron Rotor, anodized aluminum. Consists of a Supporting Base, a Disposable Polyethylene Liner, and Stainless Steel Lid. Includes Rotor Stand/Vise, one package 341251 Liners, Adapter for 342634 Liner.

Rotor Supplies

- 341251 Liner, polyethylene, 3.5 mL capacity, package of 100
- 342634 Liner, polyethylene, 2.4 mL capacity, package of 100 (Adapter required)
- 342635 Adapter for 342634 Liners, reusable
- 343779 Disposable Loading and Unloading Pipette, package of 500
- 339639 Rotor Bushing, white
- 341252 Rotor Stand/Vise
- 306812 Spinkote™ Lubricant

Batch Rotor

7 mL

Batch Rotor



Batch Rotor, Aluminum, Silver

For use in the Airfuge® Air-Driven Micro-Ultracentrifuge.

Major application: Rapid processing of fruit paste.

Max. RPM	Max. g	Minimum Fill Volume	Maximum Fill Volume	k Factor
90,000	132,000	2 mL	7 mL 8 at 2 mL	55 at 7 mL

No. 347833. Batch Rotor, aluminum, for 2- to 7-mL volumes. Sample is placed in the rotor body itself or in one of two types of polyethylene liners. A plastic window disk is placed between the rotor and the lid to contain samples during centrifugation. Includes Rotor Stand/Vise and one each 853156 O-ring, 343197 Bushing.

Rotor Supplies

- 343130 Shell Liner, polyethylene, large opening, 7-mL capacity, package of 100
- 343132 Dome Liner, polyethylene, small opening, 7-mL capacity, package of 100
- 347049 Rotor Window Disk
- 853156 Rotor O-ring
- 343197 Bushing, red



EM-90 Particle Counting Rotor, Silver

For use in the Airfuge® Air-Driven Micro-Ultracentrifuge.

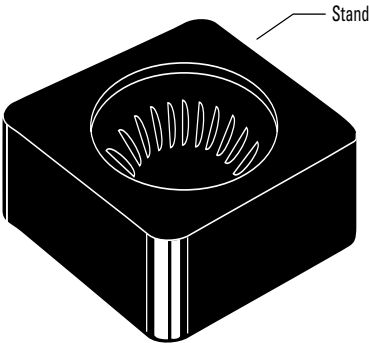
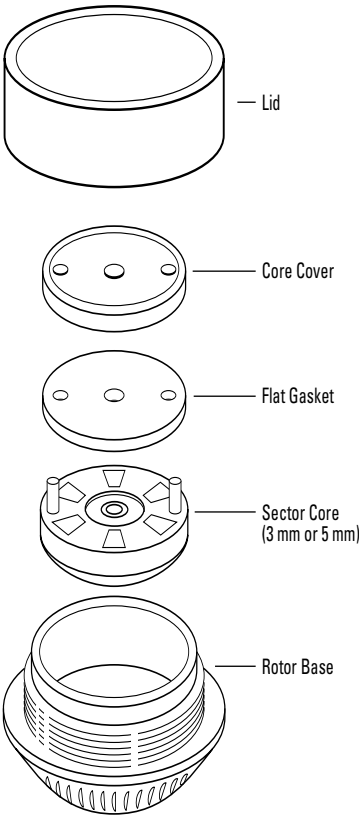
Major applications: Sedimenting particles onto filter membranes, glass cover slides, and microscope grids.

Max. RPM	Max. g	Maximum Volume	Rotor Capacity
90,000	118,000	6 x 100 µL	600 µL

No. 347844. EM-90 Electron Microscopy Particle Counting Rotor. Includes 5-mm Core with 600 µL capacity (100 µL per cell); 3-mm Core with 360 µL capacity (60 µL per cell); Rotor Stand/Vise, Gaskets, Sector Core Removal Bolt, Template, one 853156 O-ring, one 343197 Bushing.

Rotor Supplies

- 347838 Sector Core, 3 mm
- 347836 Sector Core, 5 mm
- 347840 Rotor Gaskets, package of 5
- 343197 Bushing, red



Tubes and Bottles

Tubes and Bottles For Every Application

No single tube design or material will meet all application requirements. A number of factors should be considered at the time a supply of tubes is ordered: the particular technique to be used, the nature of the sample and any solvent or gradient media, the desirability of reusing the tubes, and certain convenience factors. The properties listed below provide a guide for anyone involved in the tube selection process.

- **Strength and Flexibility**, to resist permanent deformation even when run in fixed angle rotors without tube caps
- **Chemical Resistance** to a wide range of bases, acids, and solvents
- **Transparency**, to permit a clear view of fractions and bands after centrifugation
- **Thin** enough to be sliced or punctured after centrifugation for fraction collection
- **Impermeable to Water**, to prevent aqueous solutions from permeating the tube wall and reaching the rotor cavity
- **Surface Properties** that prevent the adherence of nucleic acids and proteins
- **Temperature Tolerance** throughout a wide range of operating temperatures, without deforming at high temperatures or cracking when used close to 0°C
- **Autoclavable**, for convenient sterilization and reuse
- **Contaminant-free**, to avoid leaching extraneous materials into the sample, especially materials visible in the sensitive 240-280 nm range
- **Odor-free**, for pleasant handling

The full line of Beckman Coulter tubes includes a number of tube materials, each with its own distinct combination of properties, to meet a variety of application requirements. Available are transparent, translucent, and opaque tubes, tubes that can be sliced or punctured, tubes that can be sterilized and reused, and tubes that are resistant to a variety of chemical compounds.

Tube Selection Considerations

Compatibility of Tube Material with Solvents and Sample

The chemical compatibility of the tube materials with the gradient-forming medium or other solvent is a prime consideration. Neutral sucrose and salt solutions cause no problem. But alkaline solutions, such as those frequently used for the separation of single-stranded forms of DNA, cannot be used in Ultra-Clear™ tubes or polycarbonate tubes and bottles. Sometimes DMSO is used in preparation of sucrose gradients for sedimentation of denatured RNA. Polycarbonate and Ultra-Clear tubes are incompatible with DMSO, so polyallomer tubes should be used.

The last column of the “Quick Reference Chart to Tube Materials and Their Properties” gives some guidelines to the chemical resistances of the various tube materials. It must be emphasized, however, that other conditions of centrifugation (*g*-force, duration of run, etc.) have considerable effect on how well a tube material will withstand a particular solvent. Beckman Coulter publication IN-175, “Chemical Resistances for Beckman Coulter Centrifugation Products” (found on the Beckman Coulter web site at <http://www.beckmancoulter.com/resourcecenter/labresources/centrifuges/pdf/chemres.pdf>), provides more detailed information about the chemical resistances of the various tube materials. The wisest course is to test any questionable combination under operating conditions before making the actual run.

The type of sample, in some cases, will affect selection of a specific tube material. DNA, in its denatured or single-stranded form, will adhere to the surface of some tube materials. Polyallomer would be the best choice. (Most of this work is done in highly alkaline media which are incompatible with polycarbonate.)

Lipoprotein separations are most often done in Ultra-Clear tubes because they are clear and sliceable; these properties simplify fraction location and recovery by tube slicing. When small lipoprotein samples are to be recovered by a fractionating device and clear tubes are desirable, there are alternatives: cellulose propionate, polycarbonate, and Ultra-Clear tubes.

Hazardous materials, either pathogenic or radioactive, should be centrifuged with extreme care. All possible precautions must be taken to avoid leakage of the sample into the rotor cavity during centrifugation.

To determine the optimum tube material for your specific sample and gradient medium, refer to the quick reference chart on the next page.

Gradient Formation and Fractionation

When choosing a tube for a density gradient run, some thought should be given to gradient formation and fractionation. If the bands or zones formed during centrifugation are indistinct, they may not be visible through a translucent material such as polyallomer. If optimum band visualization is important, Ultra-Clear tubes or tubes of polycarbonate or cellulose propionate should be used. Whenever collection of bands or zones must be done by puncturing the tube or slicing, a thin, flexible tube wall is required. Ultra-Clear or polyallomer

tubes should be used, depending on the need for transparency.

As there are currently no wettable plastic centrifuge tubes available, gradients should be loaded into plastic tubes from the bottom up to avoid mixing.

High Temperature Centrifugation

Although modern centrifuges and rotors can operate at temperatures as high as 45°C, one cannot assume that every tube can be safely run over 25°C. Stainless steel and glass are the only materials which will not experience some deformation when subjected to high temperatures and long centrifugation times. Plastic tubes undergo some degree of softening at temperatures higher than 25°C. Whether or not this will cause permanent deformation is not a question of temperature alone. The centrifugal force field used, the duration of the centrifugation, the type of rotor, and even the tube angle all have an effect.

It's obviously impossible to give exact temperature limits for plastic tubes when so many other variables are involved. The safest policy is to pretest the tubes under the actual experimental conditions, but with water, rather than a valuable sample.

Tube Sizes

Tube sizes as indicated in the following charts are nominal sizes, and may vary somewhat from actual filling capacities. If a thick-walled tube is run uncapped, the maximum filling volume will depend on the tube angle of the rotor to be used. See appropriate rotor instruction manuals for maximum filling levels of tubes.

Tube Cleaning, Sterilization, and Reuse

If tubes are to be reused, special care must be taken during cleaning and sterilization. All tubes can be washed by hand with a mild detergent such as Solution 555™ diluted 5-to-1 or 10-to-1 with water. This is particularly important for polycarbonate tubes and bottles which should not be exposed to a detergent with a pH higher than 8. Tubes and bottles should not be washed in commercial dishwashers as the detergents and high temperatures are too harsh. Solvents such as alcohol or acetone react unfavorably with many tube materials. If an organic solvent must be used in the cleaning procedure, consult bulletin IN-175 for a table of tube material/solvent compatibilities (or review the same document on the Beckman Coulter web site at <http://www.beckmancoulter.com/resourcecenter/labresources/centrifuges/pdf/chemres.pdf>).

The method chosen for sterilization has direct bearing on the number of reuses one can expect from a tube. Tubes and bottles of polyallomer, polyethylene, and glass can all be autoclaved, although in general, cold sterilization methods are not as harsh as autoclaving. Cold sterilization is recommended for both polycarbonate and Ultra-Clear. Do not dry tubes, bottles, or accessories in an oven. Labware should be air dried. OptiSeal, Quick-Seal, Ultra Clear, and thinwall polyallomer tubes are intended for one-time use and should be discarded after use.

If maximum reuse is a major consideration, either polyallomer (preferably thick-walled) or polycarbonate tubes and bottles should be selected, and cold sterilization methods used. If these tubes are run completely filled in swinging bucket rotors, most of them can be reused a number of times. Chances of permanent deformation will be greater whenever the tubes are run in fixed angle rotors, without caps, and/or partially filled. All of these conditions tend to stress the centripetal edge of the tube unduly. All tubes that have been used or autoclaved previously must be individually examined for signs of deformation or cracking before using them again.

Tube Closures

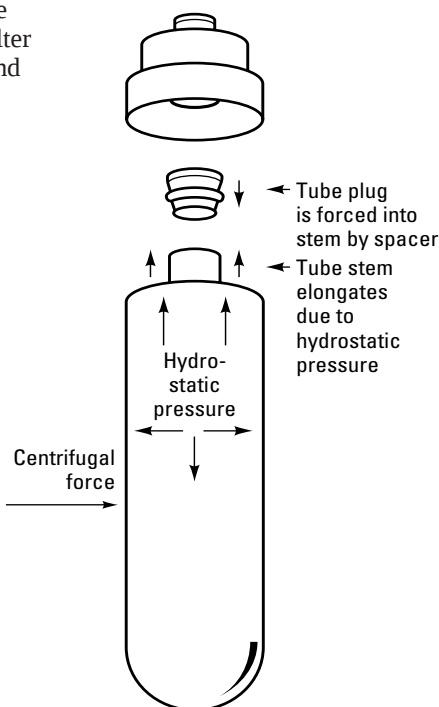
When other considerations have been resolved, convenience may be a deciding factor. Without a doubt, the most convenient tube closure is none at all; none are required for tubes run in swinging bucket rotors and in the Airfuge® Air-Drive Micro-Ultracentrifuge.

For tubes run in fixed angle rotors, alternatives to the standard tube cap assemblies are available. Bottles have three-piece cap assemblies which are easier to use than the more complex tube cap assemblies. Polycarbonate bottles are available for general-purpose fixed angle rotors, and are used frequently for differential centrifugation where band recovery is not a problem. Thickwall tubes can be run in all fixed angle rotors without caps, provided they are partially filled. (Refer to rotor manuals for more information on fill volumes.)

When closed tubes are required, Beckman Coulter offers some innovative and convenient options.

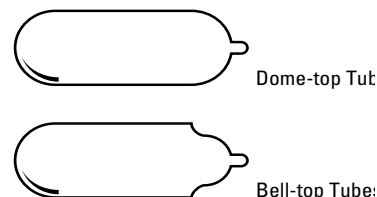
OptiSeal™ Tubes

For virtually effortless sealing, OptiSeal tubes offer the best option. You simply insert the tube plug and press, and an O-ring seals securely against the tube's inner surface. During centrifugation, the combination of *g*-force and hydrostatic pressure ensures an effective seal. Engineered for reliability, there are no tools or mechanical parts to maintain. Finger pressure is all that is needed.



Quick-Seal® Tubes

These tubes eliminate most of the steps involved in capping tubes and cut handling time in half. The top of the Quick-Seal tube is either dome-shaped or bell-shaped with a 3-mm-long inlet through which the tube is filled. The filled tube is heat-sealed using the hand-held sealer. The highly reliable seal achieved makes these tubes ideal for sample storage and for working with radioactive or pathogenic samples.



There are two Quick-Seal tube designs—dome-top and bell-top. The bell-top simplifies removal of materials that float upon centrifugation. The dome-top tubes hold more volume than their bell-top equivalents.

A Quick-Reference Chart to Tube Materials and Their Properties

Property	Thinwall Polyallomer	Thickwall Polyallomer	Ultra-Clear™	Polycarbonate	Polypropylene	Polyethylene	Cellulose Propionate
Optical	transparent	translucent	transparent	transparent	transparent	transparent/translucent	transparent
Autoclaveable	yes	yes	no	no	yes	no	no
Puncturable	yes	no	yes	no	no	yes	no
Sliceable	yes	no*	yes	no*	no	no	no*
Reusable	no	yes	no	yes	yes	yes	no
Acids (dilute or weak)	S	S	S	S	S	S	S
Acids (strong)	U	S	U	U	S	S	U
Alcohols (aliphatic)	U	S	U	U	S	S	U
Aldehydes	M	M	S	M	M	S	U
Bases	S	S	U	U	S	S	U
Esters	U	M	U	U	M	S	M
Hydrocarbons (aliphatic)	U	M	U	U	S	U	S
Hydrocarbons (aromatic and halogenated)	U	U	U	U	M	M	S
Ketones	U	M	U	U	M	M	U
Oxidizing Agents (strong)	U	U	U	M	M	M	M
Salts	S	S	M	M	S	S	S

S = satisfactory resistance

M = marginal resistance

U = unsatisfactory resistance

* Polyallomer, polycarbonate, and cellulose propionate tubes with diameters of 5 to 13 mm may be sliced using the CentriTube Slicer (part number 347960) and appropriate adapter plate.

Note: This information has been consolidated from a number of sources and is provided only as a guide to the selection of tube materials. Soak tests at 1 g (at 20°C) established the data for most of the materials; reactions may vary under the stress of centrifugation, or with extended contact or temperature variations. To prevent failure and loss of valuable sample, ALWAYS TEST SOLUTIONS UNDER OPERATING CONDITIONS BEFORE USE.

Warning: Do not use flammable substances in or near an operating centrifuge.

Tubes and Bottles

2

Nominal Filling Capacity (mL)	Nominal Size (mm)	Part No.	Rotors See specific rotor pages for required spacers/adapters/accessories
OptiSeal™ Polyallomer Tubes			
3.3	13 x 33	361627	SW-55 Ti, SW-50.1, TLN-100, MLS-50
4.7	13 x 48	361621	Types 50.4 Ti, 50.3 Ti, TLA-110, TLA-100.4
4.9	13 x 51	362185	VTi 90, VTi 65.2, NVT 90, NVT 65.2
8.9	16 x 60	361623	Types 90 Ti, 80 Ti, 70.1 Ti, 65, 50 Ti, 50
11.2	16 x 70	362181	VTi 65.1, NVT 65
32.4	26 x 77	361625	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, 42.1, 30
36.2	25 x 89	362183	VTi 50
Quick-Seal® Polyallomer Tubes			
1.0	8 x 51	345831	Type 25
1.5	11 x 25	344624	SW 60 Ti, TLA-120.2, TLA-100.2, MLA-130
2.0	11 x 32	344625	SW 60 Ti, TLA-120.2, TLA-100.2, MLA-130
2.0	13 x 25	345829	Types 100 Ti, 50.4 Ti, 50.3, VTi 90, VTi 65.2, NVT-100, SW 55 Ti, SW 50, TLA-110, TLA-100.4, TLA-100.3, MLS-50
3.5	13 x 32	349621	Types 100 Ti, TLA-110, TLA-100.3
3.5	14 x 25	355870	SW 41 Ti, SW 40 Ti
4.2	16 x 32	356562	Types 90 Ti, 80 Ti, 70.1 Ti, 65, 50 Ti, 40, SW 30.1, SW 32.1 Ti, SW 28.1, MLA-80, MLN-80
5.1	13 x 51	342412	VTi 90, VTi 65.2, NVT 100, NVT 90, NVT 65.2
5.1	13 x 51	362248	Type 100 Ti
5.9	14 x 47	355537	SW 41 Ti, SW 40 Ti
6.0	13 x 64	344619	Types 100 Ti, 50.4 Ti, 50.3 Ti
6.3	16 x 45	345830	Types 90 Ti, 80 Ti, 70.1 Ti, 65, 50 Ti, 50, 40, VTi 65.1, SW 30.1, SW 32.1 Ti, SW 28.1, MLA-80, MLN-80
8.0	16 x 58	344621	Type 50, VTi 65.1, SW 32.1 Ti, SW-28.1, MLA-80, MLN-80
10.0	16 x 67	344622	Types 90 Ti, 80 Ti, 70.1 Ti, 65, 50 Ti, 40, VTi 65.1, SW 32.1 Ti, SW 28.1
13.5	16 x 76	342413	Types 90 Ti, 80 Ti, 70.1 Ti, 65, 50 Ti, 40, VTi 65.1
15.0	25 x 38	343664	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, VTi 50, SW 30, SW 32 Ti, SW 28
17.0	16 x 102	356291	SW 32.1 Ti, SW 28.1
27.0	25 x 64	343665	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, 42.1, VTi 50, SW 32 Ti, SW 28
33.0	25 x 83	344623	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, SW 32 Ti, SW 28
39.0	25 x 89	342414	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, VTi 50
100.0	38 x 102	345776	Type 45 Ti
Quick-Seal Polyallomer konical® Tubes			
1.3	11 x 35	358655	SW 60 Ti
1.5	16 x 102	358653	SW 32.1 Ti, SW 28.1
3.0	11 x 60	358648	SW 60 Ti
3.2	13 x 51	358647	SW 55 Ti, SW 50.1 Ti, MLS-50
4.0	14 x 48	358650	SW 41 Ti, SW 40 Ti
8.0	14 x 89	358649	SW 41 Ti, SW 40 Ti
8.5	25 x 38	358652	SW 30, SW 32 Ti, SW 28
23.0	25 x 76	358654	SW 32 Ti, SW 28
28.0	25 x 83	358651	SW 32 Ti, SW 32 Ti, SW 28
Quick-Seal Ultra-Clear™ Tubes			
5.1	13 x 51	344075	VTi 90, VTi 65.2
6.0	13 x 64	344320	Types 50.4 Ti, 50.3 Ti
13.5	16 x 76	344322	Types 90 Ti, 80 Ti, 70.1 Ti, 65, 50 Ti, 40, VTi 65.1

Tubes and Bottles

2

Nominal Filling Capacity (mL)	Nominal Size (mm)	Part No.	Rotors See specific rotor pages for required spacers/adapters/accessories
Quick-Seal® Ultra-Clear™ Tubes (cont'd)			
15.0	25 x 38	344324	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, VTi 50
27.0	25 x 64	344323	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, VTi 50
39.0	25 x 89	344326	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, VTi 50
100.0	38 x 102	345778	Type 45 Ti
Ultra-Clear Tubes			
175 µL	5 x 20	344718	A-110, A-100/30, A-100/18
450 µL	8 x 20	345843	A-95
0.8	5 x 41	344090	SW 55 Ti, SW 50.1, MLS-50
2.0	8 x 49	344091	Types 90 Ti, 80 Ti, 70.1 Ti, 65, 50 Ti, 50.3 Ti, 50, 40
2.2	11 x 34	347356	TLS-55
3.0	13 x 32	344092	Types 90 Ti, 80 Ti, 70.1 Ti, 65, 50 Ti, 50, 40
4.0	11 x 60	344062	SW 60 Ti
4.0	13 x 41	344093	Types 90 Ti, 80 Ti, 70.1 Ti, 65, 50 Ti, 50, 40
5.0	13 x 51	344057	SW 55 Ti, SW 50.1, MLS-50
6.5	13 x 64	344088	Types 90 Ti, 80 Ti, 70.1 Ti, 70 Ti, 65, 60 Ti, 55.2 Ti, 50.4 Ti, 50.3 Ti, 50.2 Ti, 50 Ti, 45 Ti, 40.3, 40.2, 40, 21
8.0	16 x 51	346600	SW 30.1
10.0	16 x 64	344089	Type 50
10.5	13 x 89	344087	Types 45 Ti, 21
13.2	14 x 89	344059	SW 41 Ti
13.5	16 x 76	344085	Types 90 Ti, 80 Ti, 70.1 Ti, 70 Ti, 65, 60 Ti, 55.2 Ti, 50.2 Ti, 50 Ti, 45 Ti, 40, 21
14.0	14 x 95	344060	SW 40 Ti
17.0	16 x 102	344061	SW 32.1 Ti, SW 28.1
20.0	25 x 50	346598	SW 30
34.0	25 x 76	344063	SW 25.1
38.5	25 x 89	344058	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, SW 32 Ti, SW 28
94.0	38 x 102	345777	Types 45 Ti, 21
Thinwall Polyallomer Tubes			
175 µL	5 x 20	342630	A-110, A-100/30, A-100/18
2.2	11 x 34	347357	TLS-55
4.0	11 x 60	328874	SW 60 Ti
5.0	13 x 51	326819	SW 55 Ti, SW 50.1, MLS-50
6.5	13 x 64	326820	Types 90 Ti, 80 Ti, 70.1 Ti, 70 Ti, 65, 60 Ti, 55.2 Ti, 50.4 Ti, 50.3 Ti, 50.2 Ti, 50 Ti, 45 Ti, 40, 40.3, 40.2, 21
8.0	16 x 51	346601	SW 30.1
10.0	16 x 64	326826	Type 50
10.5	13 x 89	326822	Types 45 Ti, 21
13.2	14 x 89	331372	SW 41 Ti
13.5	16 x 76	326814	Types 90 Ti, 80 Ti, 70.1 Ti, 70 Ti, 65, 60 Ti, 55.2 Ti, 50.2 Ti, 50 Ti, 45 Ti, 40, 30, 21
14.0	14 x 95	331374	SW 40 Ti
17.0	16 x 102	337986	SW 32.1 Ti, SW 28.1
20.0	25 x 50	346599	SW 30
35.5	25 x 83	344367	Type 70 Ti
38.5	25 x 89	326823	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, SW 32 Ti, SW 28
94.0	38 x 102	345775	Types 45 Ti, 21

Tubes and Bottles

2

Nominal Filling Capacity (mL)	Nominal Size (mm)	Part No.	Rotors See specific rotor pages for required spacers/adapters/accessories
Thinwall Polyallomer, konical™ Tubes			
1.5	11 x 35	358117	SW 60 Ti
3.0	11 x 60	358118	SW 60 Ti
3.0	13 x 51	358119	SW 55 Ti, SW 50.1 Ti, MLS-50
5.5	16 x 51	358122	SW 30.1, SW 28.1
10.0	14 x 89	358120	SW 41 Ti, SW 40 Ti
11.0	14 x 95	358121	SW 40 Ti
14.5	16 x 102	358123	SW 32.1 Ti, SW 28.1
25.0	25 x 76	358125	SW 32 Ti, SW 28
30.0	25 x 89	358126	SW 32 Ti, SW 28
Thickwall Polyallomer Tubes			
230 µL	7 x 20	343621	Type 42.2 Ti
.5	8 x 34	343777	TLA-120.1, TLA-100.1
1.0	11 x 34	347287	TLA-120.2, TLA-100.2, MLA-130, TLS-55
3.0	11 x 60	355636	SW 60 Ti
3.2	13 x 56	362333	TLA-110, TLA-100.4
3.5	11 x 60	355641	Type 45 Ti
3.5	13 x 51	349623	SW 55 Ti, SW 50.1, TLA-110, TLA-100.3, MLS-50
4.0	13 x 64	355644	Types 90 Ti, 80 Ti, 70.1 Ti, 70 Ti, 65, 60 Ti, 55.2 Ti, 50.4 Ti, 50.3 Ti, 50.2 Ti, 50 Ti, 45 Ti, 40, 21
10.0	16 x 64	355646	Type 50, MLA-80
10.5	13 x 89	355639	Types 45 Ti, 21
13.5	16 x 76	355640	Types 90 Ti, 80 Ti, 75 Ti, 70.1 Ti, 70 Ti, 65, 60 Ti, 55.2 Ti, 50.2 Ti, 50 Ti, 45 Ti, 42.1, 40, 35, 30, 21, SW 25.1
17.5	25 x 50	355658	SW 30
32.0	25 x 89	355642	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, SW 32 Ti, SW 28
94.0	38 x 102	355643	Types 45 Ti, 21
Thickwall Polycarbonate Tubes			
230 µL	7 x 20	343775	Type 42.2 Ti
.5	8 x 34	343776	TLA-120.1, TLA-100.1
1.0	8 x 51	355657	Types 50.4 Ti, 25
1.0	11 x 34	343778	TLA-120.2, TLA-100.2, MLA-130, TLS-55
3.0	11 x 60	355635	SW 60 Ti
3.2	13 x 56	362305	TLA-110, TLA-100.4
3.5	13 x 51	349622	SW 55 Ti, SW 50.1, TLA-110, TLA-100.3, MLS-50
3.5	13 x 51	355632	Type 45 Ti
4.0	13 x 64	355645	Types 90 Ti, 80 Ti, 70.1 Ti, 70 Ti, 65, 60 Ti, 55.2 Ti, 50.4 Ti, 50.3 Ti, 50.2 Ti, 50 Ti, 45 Ti, 40, 21
10.5	13 x 89	355629	Types 45 Ti, 21
10.0	16 x 64	355647	Type 50, MLA-80
13.5	16 x 76	355630	Types 90 Ti, 80 Ti, 75 Ti, 70.1 Ti, 70 Ti, 65, 60 Ti, 55.2 Ti, 50.2 Ti, 50 Ti, 45 Ti, 40, 21
17.5	25 x 50	355659	SW 30
32.0	25 x 89	355631	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, SW 32 Ti, SW 28
34.0	25 x 76	355637	SW 25.1
94.0	38 x 102	355628	Types 45 Ti, 21

Tubes and Bottles

2

Nominal Filling Capacity (mL)	Nominal Size (mm)	Part No.	Rotors See specific rotor pages for required spacers/adapters/accessories
Cellulose Propionate Tubes			
230 µL	7 x 20	342303	Type 42.2 Ti
Stainless Steel Tubes			
10.0	16 x 64	303955	Type 50
38.5	25 x 89	301112	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, 42.1, SW 28
94.0	38 x 102	303380	Types 45 Ti, 21
Polyethylene Tubes			
175 µL	5 x 20	343622	A-110, A-100/30, A-100/18
Polyallomer Tubes with Snap-on Caps			
1.5	11 x 40	357448 (Natural)	TLA-110, TLA-100.4, TLA-100.3, TLA-55, TLA-45

Bottle Assemblies with Three-Piece Caps

Nominal Filling Capacity (mL)	Nominal Size (mm)	Bottle & Cap Assembly	Bottle Only	Cap Assembly	Cap Only	Plug Only	O-ring Only	Rotors
Bottle and Cap Assembly								
PC — 8.5	16 x 64	355615	355656	355604	335257	335256	870409	Type 50
PC — 10.4	16 x 76	355603	355651	355604	335257	335256	870409	Types 90 Ti, 80 Ti, 75 Ti, 70.1 Ti, 65, 50 Ti, 40
PC — 26.3	25 x 89	355616	355654	355617	335259	335258	870385	Type 30
PC — 26.3	25 x 89	355618 ¹	355654	355619	338824	335258	870385	Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, 42.1
PC — 70.0	38 x 102	355620 ²	355655	355621	334547	334545	870384	Types 35, 21
PC — 70.0	38 x 102	355622 ²	355655	335623	339165	334545	870384	Type 45 Ti
PA — 250.0	60 x 120	334205	355627	362247	362246	332836	812715	Type 19
PP — 250.0	62 x 122	356011	358326	358977	357490	N/A	927860	Type 16
PC — 250.0	62 x 122	356013	358275	358977	357490	N/A	927860	Type 16

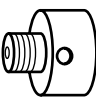
Note: Regarding packaging, bottle and cap assemblies are packaged in units of 6, with the following exceptions: Bottle and Cap assembly 334205 is packaged as one; Bottles 355656 and 355651 are packaged in units of 25; Cap assembly 334543 is packaged as one. Caps, Plugs, and O-rings are packaged separately.

¹The only difference between these two assemblies is the cap which is Noryl in the 355616 assembly and aluminum in the 355618 assembly. The Noryl cap can be used in the Type 30 Rotor.

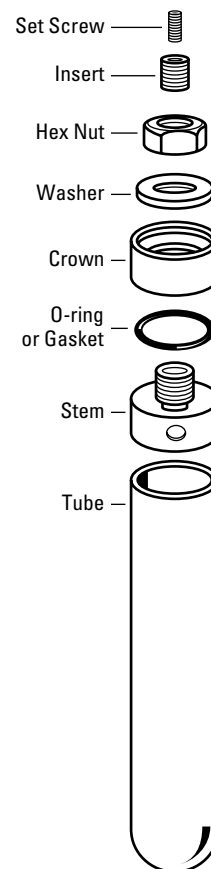
²The only difference between these two assemblies is the cap which is Noryl in the 355620 assembly and aluminum in the 355622 assembly. The Noryl cap can be used in the Type 35 and 21 Rotors; the aluminum cap is required for the higher speed forces of the Type 45 Ti.

Tubes and Bottles

Tube Cap Assemblies and Parts

Cap Material	Tube Cap	Hex Nut	Crown	Set Screw	Insert	O-ring or Gasket	Stem
							
5/16 in. (8mm)							
Al	303624	303379	303809	—	—	303730	303377
Al	303658	303379	303810	—	—	303730	303377
1/2 in. (13 mm)							
Al	303113	301870	307004	—	—	344672	307005
Al	346256	301870	307004	803543	302312	344672	346246
Al/SS	305022	301870	307004	—	—	344672	302331
5/8 in. (16 mm)							
Al	303319	301870	307006	338864	302312	301869	302266
Al	330860	301870	330774	803543	302312	858046	330788
Al	338907	301870	338911	338864	302312	878572	338910
Ti	341968	335320	335319	338864	302312	858046 870380	341969
1 in. (25 mm)							
Al	302359	301870	302169	338864	302312	301473	302168
Al	302133	301870	302169	338864	302312	301473	302138
Al	331151	330791	331153*	338864	302312	334280	331152
Al/Ti	337927	330791	338863*	338864	302312	—	338865
Al	338901	330791	338912*	338864	302312	878188	338908
Al	338906	330791	338915*	338864	302312	878188	338908
1 1/2 in. (38 mm)							
Al	326891	301870	326890	808482	302312	346242	326889
Al	326905	301870	326890	338864	302312	801761	326899
Al	330901	330791	330793*	338864	302312	346242	330900
Al	338903	330791	338914*	338864	302312	341767	338909
Al	338905	330791	338913*	338864	302312	341767	338909

* Also order 330899 Washer



Tools, Accessories, and Supplies

Sample preparation and recovery are important steps in the centrifugation process. To help in these often time-consuming steps, Beckman Coulter provides a number of tools and accessories for use in preparing your samples for centrifugation as well as for recovering the particles of interest when your separation is complete.

Everything you need can be conveniently ordered from the following listings.

Required Tools

If you're running capped tubes in the following rotors: Types 80 Ti, 75 Ti, 70.1 Ti, 70 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, 50 Ti, 45 Ti, 42.1 or 35, you'll need the following tools:

331202 Tool Kit	305075 Cap Vise
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If you're running 337927 caps in the Type 70 Ti rotor, you'll need:

338841 Tool Kit	305075 Cap Vise
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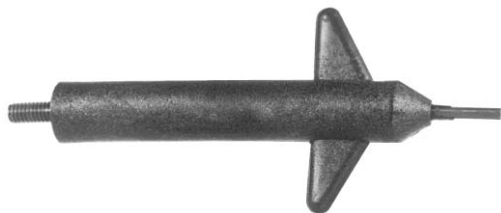
If you're running Quick-Seal® tubes, you'll need:

358312 Cordless Tube Topper (U.S. and Japan)
358313 Cordless Tube Topper (Europe)
358314 Cordless Tube Topper (Great Britain)
358315 Cordless Tube Topper (Australia)

Note: For further information, refer to the specific technical bulletin from the Technical Publications Department.

Tools for Fixed-Angle Rotors (see also Tools for Quick-Seal Tubes)

301875 Removal Tool, for capped tubes



841884 Hex Driver, for 5/16-in. (8 mm) hex nuts



302460 Nylon Insert Tool, for cap stem filling hole



858122 Socket Adapter, for 858123 Socket below



305075 Tube-Cap Vise



858123 Socket, for tightening red, blue, and black aluminum caps, 3/4-in. (19 mm) hex nut



841883 Hex Driver, for 7/16-in. (11 mm) hex nuts



870432 Socket, for tightening titanium caps (cap 341968), 7/16-in. (11 mm) hex nut



Tools for Fixed-Angle Rotors (cont'd)

878133 Removal Tool, for polycarbonate bottles with aluminum caps



331325 Centering Tool, for replacing overspeed disk



338841 Tool Kit, for Type 70 Ti Rotor when 344367 Tubes and 337927 Caps are used. Includes the following:

301875 Removal Tool, for capped tubes

338835 Tube Cap Vise

338840 Tube Cap Assembler

858121 Torque Wrench

858122 Socket Adapter

858123 Socket, for $\frac{3}{4}$ -in. (19 mm) hex nut

870432 Socket, for $\frac{7}{16}$ -in. (11 mm) hex nut

335381 Removal Tool, for polycarbonate bottles with Noryl caps



331202 Tool Kit for capped thin-wall and thick-wall tubes when used in Type 80 Ti, 75 Ti, 70.1 Ti, 60 Ti, 55.2 Ti, 50.2 Ti, 50 Ti, 45 Ti, 42.1 and 35 Rotors. Also needed for Types 30 and 21 Rotors if capped thickwall tubes are used. Includes the following:

301875 Removal Tool, for capped tubes

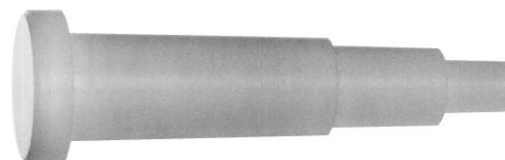
858121 Torque Wrench

858122 Socket Adapter

858123 Socket, for $\frac{3}{4}$ -in. (19 mm) hex nut

870432 Socket, for $\frac{7}{16}$ -in. (11 mm) hex nut

303419 Removal Tool, for Delrin tube adapters (not for use with adapters for konical™ Tubes)



Tools for Vertical-Tube and NVT™ Rotors (See also Tools for Quick-Seal® Tubes)

Note: VTi 65, VTi 65.1 and VTi 50 rotors manufactured prior to 8/87 were equipped with pin-style and square-style plugs, and require specific tools mentioned in the bottom of this section. To update these rotors, purchase a full set of the new hex-style plugs and the appropriate tools.

332688 Rotor Vise, for VTi 65 and VTi 50 rotors



342705 Rotor Vise, for VTi 90, NVT 100*, NVT 90, NVT-65, VTi 65.1, VTi 65.2, and VAC 50 rotors



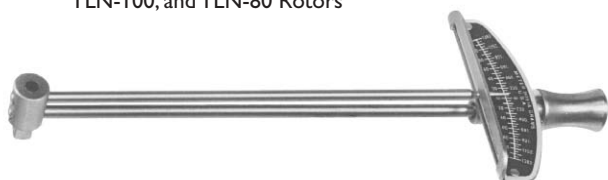
*Requires adapter 342705.

355588 Hex Plug-wrench Adapter for VTi 50, VC 53, VAC 50 Rotors

356306 Hex Plug-wrench Adapter for VTi 90, VTi 65, VTi 65.1, VTi 65.2, and MLN-80 Rotors

889096 Torque Wrench, 600 in.-lb., for VTi 50, VC 53, VAC 50 Rotors

858121 Torque Wrench, 200 in.-lb. for VTi 90, VTi 65, VTi 65.1, VTi 65.2, NVT 100, NVT 90, NVT 65.2, VTi 80, TLN-120, TLN-100, and TLN-80 Rotors



Reminder: These items are supplied with the Rotor Package; order only as replacements.

Tools for VTi 65, VTi 65.1 and VTi 50 Manufactured before 8/87

340632 Four-hole Plug-wrench Adapter for VTi 50 Rotors

345795 Two-hole Plug-wrench Adapter for VTi 65 Rotors

347372 Hex Plug Adapter for TLN-120, TLN-100, TLV-100

347373 Rotor Vise for TLN-120, TLN-100, TLV-100, TLN-80

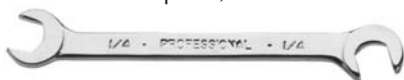
889096 Torque Wrench for VTi 50, VC 50, VAC 50

976959 Torx Adapter for NVT 100, NVT 90, NVT 65.2, VTi 90, VTi 65.2, TLV-100, TLN-120



Tools for Swinging-Bucket Rotors

001878 Bucket Cap Tool, for SW 60 Ti Rotor



354468 Removal Tool, for konical Tube Adapters

332400 Rotor Stand

927208 Hemostat (6-in., curved)

330070 Hinge Pin Tool, for SW 65 Ti, SW 41 Ti and SW 40 Ti Rotors



Reminder: These items are supplied with the Rotor Package; order only as replacements.

Tools for Zonal Rotors (See also Tools for Quick-Seal Tubes)

001884 Hex Wrench, 5/64-in. (1.9 mm), for Support Band

332618 Seal Disassembly Tool

332848 Locating Spacer, for Ti-15, Al-15, Ti-14 Rotors

819247 Lubriplate Grease, 1 1/4-oz. Tube

328917 Tool Kit, for Zonal Rotors.

Includes the following:

332688 Rotor Vise

332690 Spanner Wrench

333763 Tubing Removal Tool

858532 Pliers

Supplies

- 335148** Vacuum Grease, 1-oz. jar
- 306812** Spinkote™ Lubricant, 2-oz. tube
- 347404** Brush, for cleaning rotor cavities, ¼ in. to ½ in. (6 to 13 mm) in diameter; minimum order of three.
- 339379** Brush, for cleaning rotor cavities, ⅞ in. to 1 in. (11 to 25 mm) in diameter; minimum order of three.
- 339380** Brush, for cleaning rotor cavities, 1 in. to 1½ in. (25 to 38 mm) in diameter; minimum order of three.
- 339558** Rotor Cleaning Kit (see description on page 2–19) includes: one 339379 Brush, one 339380 Brush and two bottles of 339555 Rotor Cleaning Concentrate
- 339555** Rotor Cleaning Concentrate, Solution 555™, 946-mL bottle; minimum order of two

- 330049** Logbook, for Preparative Ultracentrifuge Instruments



- 339587** Master Rotor Logbook



- 339648** Rotor Record Cards, package of five pads



Tools for Quick-Seal® Tubes

- 338765** Removal Tool, for Floating Spacers (except when used in Swinging Bucket Rotors)



- 354468** Removal Tool, for konikal™ Tube Adapters used in Swinging Bucket Rotors



- 342415** Funnel



- 348120** Seal Formers (round-topped) for use with Tube Topper

- 345395** Ultra-Clear™ Tube Sealing Oil, 7.5 mL bottle

- 361668** Removal Tool for Tubes and Spacers (and Floating Spacers in Swinging Bucket Rotors)



Quick-Seal® Tube Racks

For Cordless Tube Topper

These autoclavable racks accommodate Quick-Seal Tubes for use with the Cordless Tube Topper.

- 349661** Tube Rack (Orange), for $\frac{5}{16}$ -in. (8 mm) diameter Tubes
- 349387** Tube Rack (Gold), for $\frac{7}{16}$ -in. (11 mm) diameter Tubes
- 348122** Tube Rack (Red), for $\frac{1}{2}$ -in. (13 mm) diameter Tubes
- 356568** Tube Rack (Violet), for $\frac{5}{8}$ -in. (14 mm) diameter Tubes
- 348123** Tube Rack (Green), for $\frac{3}{4}$ -in. (16 mm) diameter Tubes
- 348124** Tube Rack (Blue), for 1-in. (25 mm) diameter Tubes
- 348125** Tube Rack (Black), for 1½-in. (38 mm) diameter Tubes



2

Tools for OptiSeal™ Tubes

For easy handling of OptiSeal Tubes, specially designed Tube Racks and Removal Tools are available.

- 338765** Removal Tool, for $\frac{5}{8}$ -in Floating Spacer (362202)
- 360534** OptiSeal Tube Rack, for $\frac{1}{2} \times 2$ -in. (13 x 51 mm) Tubes
- 360538** OptiSeal Tube Rack, for $\frac{5}{8} \times 2\frac{3}{4}$ -in. (16 x 70 mm) Tubes
- 360542** OptiSeal Tube Rack, for 1 x 3½-in. (25 x 89 mm) Tubes
- 361638** OptiSeal Tube Rack, for $\frac{1}{2} \times 1\frac{7}{8}$ -in. (13 x 48 mm) Tubes
- 361642** OptiSeal Tube Rack, for $\frac{5}{8} \times 2\frac{3}{8}$ -in. (16 x 60 mm) Bell top Tubes
- 361646** OptiSeal Tube Rack, for 1 x 3¼-in. (25 x 77 mm) Bell top Tubes
- 361650** OptiSeal Tube Rack, for $\frac{1}{2} \times 1\frac{1}{2}$ -in. (13 x 33 mm) Tubes
- 361668** OptiSeal Tube Extraction Tool



Cordless Tube Topper

358312 Tube Topper Kit, 60 Hz (for U.S. and Japan)

358313 Tube Topper Kit, 50 Hz (for Europe)

358314 Tube Topper Kit, 50 Hz (for Great Britain)

358315 Tube Topper Kit, 50 Hz (for Australia)

Each Kit Contains:

1 each 348117 Heatsink, 2 each 348643 Seal Guide,
8 each 348120 Seal Former (domed top), 1 each Tube Topper
and Charging Unit, 1 each 361668 Tube Extractor.

Replacement Parts

348117 Heat Sink

348120 Seal Former (domed top) for Tube Topper

357442 Flat-top Seal Former for Tube Sealer

348643 Seal Guide

889676 Plastic Box for holding Accessories

342415 Funnels (two)

338765 Removal Tool for Plastic Spacers and Floating Spacers

343890 Fraction Recovery System

347960 CentriTube Slicer Kit (for TL-series tubes)

358317 Tip

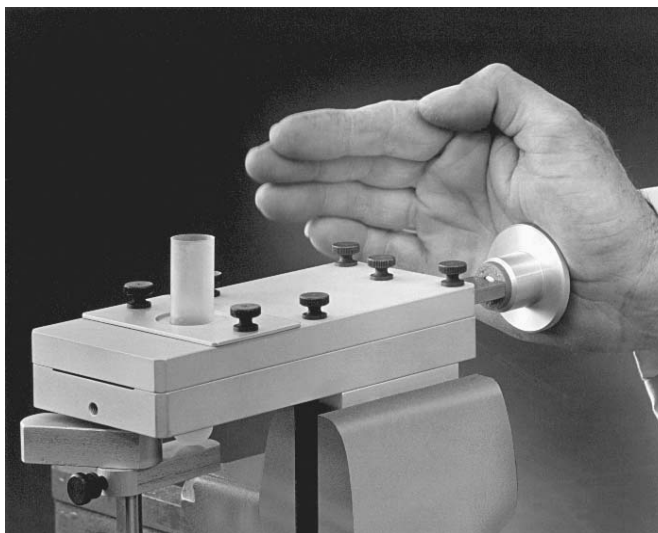
927937 Battery

961601 Lamp (screw-type socket)

974874 Lamp (bayonet-type socket)



Tube Slicer — for Preparative Ultracentrifuge Tubes



303811 Tube Slicer Kit, contains parts listed below.
(Note: Vise not included.)

Replacement Parts

- 303838** Blade
- 303920** Rubber Ring, $\frac{3}{16}$ -in. (8 mm), two required
- 303924** Metal Shim Ring, $\frac{3}{16}$ -in. (8 mm), two required
- 338516** Rubber Ring, $\frac{7}{16}$ -in. (11 mm), two required
- 338517** Metal Shim Ring, $\frac{7}{16}$ -in. (11 mm), two required
- 303919** Rubber Ring, $\frac{1}{2}$ -in. (13 mm), two required
- 303923** Metal Shim Ring, $\frac{7}{16}$ -in. (13 mm), two required
- 332693** Rubber Ring, $\frac{9}{16}$ -in. (14 mm), two required
- 332692** Metal Shim Ring, $\frac{9}{16}$ -in. (14 mm), two required
- 303918** Rubber Ring, $\frac{5}{8}$ -in. (16 mm), two required
- 303922** Metal Shim Ring, $\frac{5}{8}$ -in. (16 mm), two required
- 303917** Rubber Ring, 1-in. (25 mm), two required
- 303921** Metal Shim Ring, 1-in. (25 mm), two required
- 303830** Blade Assembly
- 829623** Thumbscrew

CentriTube Slicer — for Micro Ultracentrifuge Tubes



347960 CentriTube Slicer Kit. Includes Adapter Plates, Blades, Storage Box, Hardware Kit, Spinkote™ Lubricant, and Instruction Manual.

Replacement Parts

- 354446** Adapter Plate, 7 mm diameter
- 354445** Adapter Plate, 8 mm diameter
- 354444** Adapter Plate, 11 mm diameter
- 354443** Adapter Plate, 13 mm diameter
- 348299** Blades, package of 10
- 889676** Plastic Storage Box
- 348307** Replacement Hardware Kit (3 thumbscrews, 1 set of blade clips)
- 306812** Spinkote Lubricant

Rotor Cleaning Kit



339558 Rotor Cleaning Kit. Contains two 946-mL bottles of Solution 555™ Rotor Cleaning Concentrate, 339379 Rotor Cleaning Brush, and 339380 Rotor Cleaning Brush

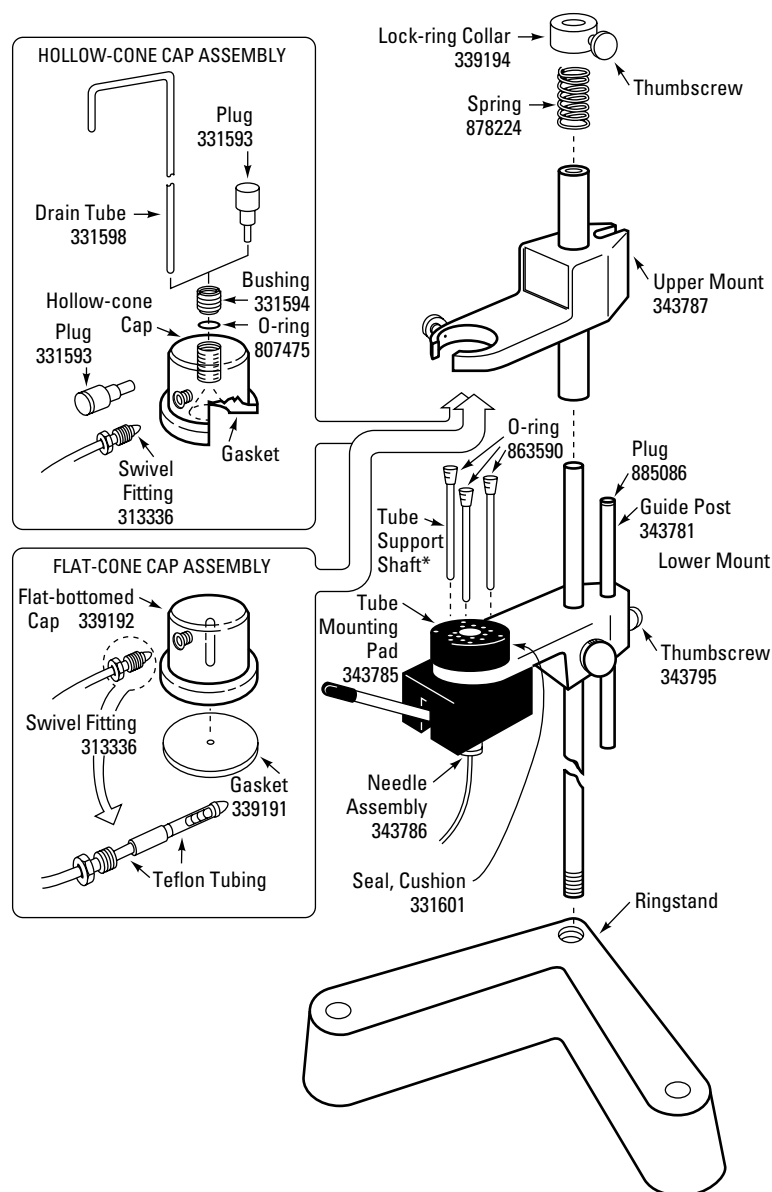
Replacement Parts/Supplies

339555 Solution 555 Rotor Cleaning Concentrate (min. order two Bottles)

339379 Rotor Cleaning Brush, 5/16-in. (16 mm) and 1-in. (25.4 mm), for Rotor Cavity diameters from 7/16-in. (11 mm) to 1-in. (25.4 mm) (min. order three Brushes)

339380 Rotor Cleaning Brush, 1 1/4-in. (32 mm) and 1 1/2-in. (38 mm), for Rotor Cavity diameters from 1-in. (25.4 mm) to 1 1/2-in. (38 mm) (min. order three Brushes)

Fraction Recovery System



Two types of systems are available: one with a flat-bottomed cap, and those with hollow-cone caps. Using the flat-bottomed cap, sample is removed through a puncture hole in the bottom of the tube. This cap fits any tube diameter and must be used to fractionate Quick-Seal® tubes. The four hollow-cone cap systems are used for sample recovery from tubes that cannot be punctured or for recovery from the tops or bottoms of puncturable tubes. Each hollow-cone system is for a single tube diameter.

System Part Numbers

- 343890** Fraction Recovery System with flat-bottomed Cap for puncturing all Tubes, including Quick-Seal Tubes*.
- 342023** Fraction Recovery System with Hollow-cone Cap for 1/2-in. Tubes.
- 342024** Fraction Recovery System with Hollow-cone Cap for 3/8-in. Tubes.
- 342025** Fraction Recovery System with Hollow-cone Cap for 7/16-in. Tubes.
- 342026** Fraction Recovery System with Hollow-cone Cap for 1-in. Tubes.

Hollow-Cone Caps

- 331562** Hollow-cone Cap for 1-in. diameter Tubes
- 331591** Gasket for 331562 Cap
- 331563** Hollow-cone Cap for 1 1/4-in. diameter Tubes
- 331589** Gasket for 331563 Cap
- 331564** Hollow-cone Cap for 5/8-in. diameter Tubes
- 331588** Gasket for 331564 Cap
- 331565** Hollow-cone Cap for 1/2-in. diameter Tubes
- 331587** Gasket for 331565 Cap
- 331566** Hollow-cone Cap for 7/16-in. diameter Tubes
- 331586** Gasket for 331566 Cap
- 334310** Hollow-cone Cap for 7/16-in. diameter Tubes
- 334312** Gasket for 334310 Cap

Replacement Parts for Discontinued 339187 Universal Fraction Recovery System

- 331584** Piercing Screw
- 343786** Needle Assembly
- 343804** Retrofit Kit, includes lower mount (shown left) for lever puncturing to 343890
- 819838** Setscrew with plastic tip

*346105 Tube Support Shaft, 2-in., 346106 Tube Support Shaft, 3-in., both included in 343890.

Reference

Guide to Centrifuge Selection

Centrifugation is a basic separation technique that is utilized at multiple stages in the study of sample components. Flexible rotor and adapter systems for Beckman Coulter centrifuges allow them to be used across multiple application areas. To help you select the most appropriate centrifuge for your work, the following charts provide brief descriptions of the kinds of separations typically achieved using various centrifuges. These charts list frequent separation requirements for each sample type and identify the centrifuges that are typically used to meet those requirements.

In addition to the separation and isolation of sample particles, centrifugation is increasingly being used as an analytical technique for the study of macromolecular interactions and the determination of molecular weights. Instruments for these applications are also listed below.

Quick-Reference Guide to Centrifuge Selection

Materials to be Isolated	Specific Application	Centrifuges Typically Used											
		Optima™ L and XL	L8M	L7-65, L7-80	Optima™ TLX	Optima™ MAX	Airfuge®	L7 35	J2 Series	J6 Series	Allegra® Series	Microfuge	Avanti® Series
Preparative Centrifugation													
Proteins	Ammonium sulfate precipitates	•	•	•	•	•	•	•	•			•	•
	Sucrose/glycerol gradient isolation	•	•	•	•	•	•	•	•				
	Centrifugal filtration							•	•	•		•	
Lipoproteins	Fractionation by flotation	•	•	•	•	•							
	Density gradient fractionation	•	•	•	•	•		•					
	Fractionation by precipitation						•						
	Chylomicron removal						•						
Subcellular Fractions													
Chromatin/Nucleosomes	Sucrose gradient isolation	•	•	•	•	•		•	•				•
Microsomes	Pelleting	•	•	•	•	•		•					
	Sucrose gradient isolation	•	•	•	•	•		•					
	Microsomal membrane fractionation	•	•	•	•	•		•					
Mitochondria	Pelleting	•	•	•	•	•	•	•	•				•
	Sucrose gradient isolation	•	•	•		•		•					
Nuclei	Pelleting	•	•	•	•	•		•	•	•	•		•
Membranes	Pelleting	•	•	•	•	•	•	•	•				•
	Sucrose/Percoll gradient fractionation	•	•	•	•	•		•	•				•
	Binding studies	•	•	•	•	•	•					•	
Ribosomes/Polysomes	Pelleting	•	•	•	•	•	•	•					
	Size fractionation in sucrose gradients	•	•	•		•							
Cytosol	Clarification	•	•	•	•	•	•	•	•				•

Quick-Reference Guide to Centrifuge Selection (cont.)

Materials to be Isolated	Specific Application	Centrifuges Typically Used											
		Optima™ L and XL	L8M	L7-65, L7-80	Optima TLX	Optima MAX	Airfuge®	L7 35	J2 Series	J6 Series	Allegra® Series	Microfuge	Avant® Series
Preparative Centrifugation													
Lysates/Homogenates	Clearing debris and large particles	•	•	•	•	•	•	•	•	•	•		•
Nucleic Acids DNA	Alcohol precipitation							•	•			•	•
	Phenol/CHCl ₃ extraction							•	•			•	•
	Plasmid purification in CsCl	•	•	•	•	•							
	Size fractionation in sucrose gradients	•	•	•	•	•							
	Minipreps in 96-well plates									•	•		
	Spin columns								•	•	•		•
RNA	Phenol/CHCl ₃ extraction							•	•			•	•
	Alcohol precipitation							•	•			•	•
	Lithium precipitation							•	•			•	•
	Pelleting in CsCl	•	•	•	•	•							
	CSTFA density gradient	•	•	•	•	•	•						
Cells	Isolation of mononuclear cells on Ficoll-Hypaque									•	•		
	Pelleting bacteria							•	•	•	•		•
	Pelleting mammalian cells									•	•		
	Elutriation of viable cells								•	•			•
	Other density gradient separations							•	•	•	•		•
Viruses	Pelleting	•	•	•		•		•	•				•
	PEG precipitates							•	•				•
	Density gradient isolations	•	•	•		•		•					
Blood	Plasma preparation									•	•		
	Blood Cell products									•	•		

How to Choose a Rotor

When choosing a rotor, there are several factors to consider: your sample volume and number of individual samples; the number of components in each sample; the level of purity your research requires; and how quickly you wish to achieve the separation.

The Importance of *k* Factor

Obviously, separation is affected by maximum speed and maximum radius which together determine maximum *g*-force. However, particle pathlength also affects separation time. A simple measure of overall rotor efficiency which incorporates both *g*-force and particle pathlength is the *k* factor. Generally speaking, the lower the *k* factor, the shorter the run time. This makes the *k* factor one of the most important considerations when selecting a rotor. The chart on page 3–5 compares *k* factors among the four basic rotor types. (Refer to page 3–12 for useful formulas relating to *k* factors.)

Rotor Material

Beckman Coulter ultracentrifuge rotors are made of either aluminum, or titanium.

- Aluminum rotors are relatively light and easy to handle, but less durable and slightly more susceptible to corrosion than titanium rotors. Beckman Coulter still offers some aluminum rotors for customers who own older ultracentrifuges, the primary instruments for which these rotors were originally designed.
- Titanium rotors are generally stronger and more resistant to corrosion, making them the logical choice for rapid separation at high speeds or when corrosive chemicals will be used.

Swinging-Bucket (SW) Rotors

Generally used when maximum resolution of sample zones is needed, as in rate zonal studies. Because tubes are held in a horizontal position while spinning, the pathlength is the full length of the tube, which results in longer run times than with other rotor types. These long run times are offset by excellent resolution of sample bands in rate zonal separations. Swinging-Bucket Rotors are also the best choice when a compact pellet is needed, as when pelleting RNA through a cesium chloride cushion.

Fixed-Angle (FA) Rotors

These rotors provide faster run times than SW rotors at the expense of some resolution in rate zonal studies. They are most useful for pelleting and for isopycnic banding of DNA, where a shallow density gradient and reorientation combine to increase both the width of sample bands and the distance between them, making band extraction easier.

Vertical-Tube (VT) Rotors

These rotors are often used for isopycnic and rate zonal separations when run-time reduction is important. Since vertical tube rotors hold sample tubes parallel to the axis of rotation, particle pathlengths are limited to the diameter of the tube — a short pathlength that results in fast run times.

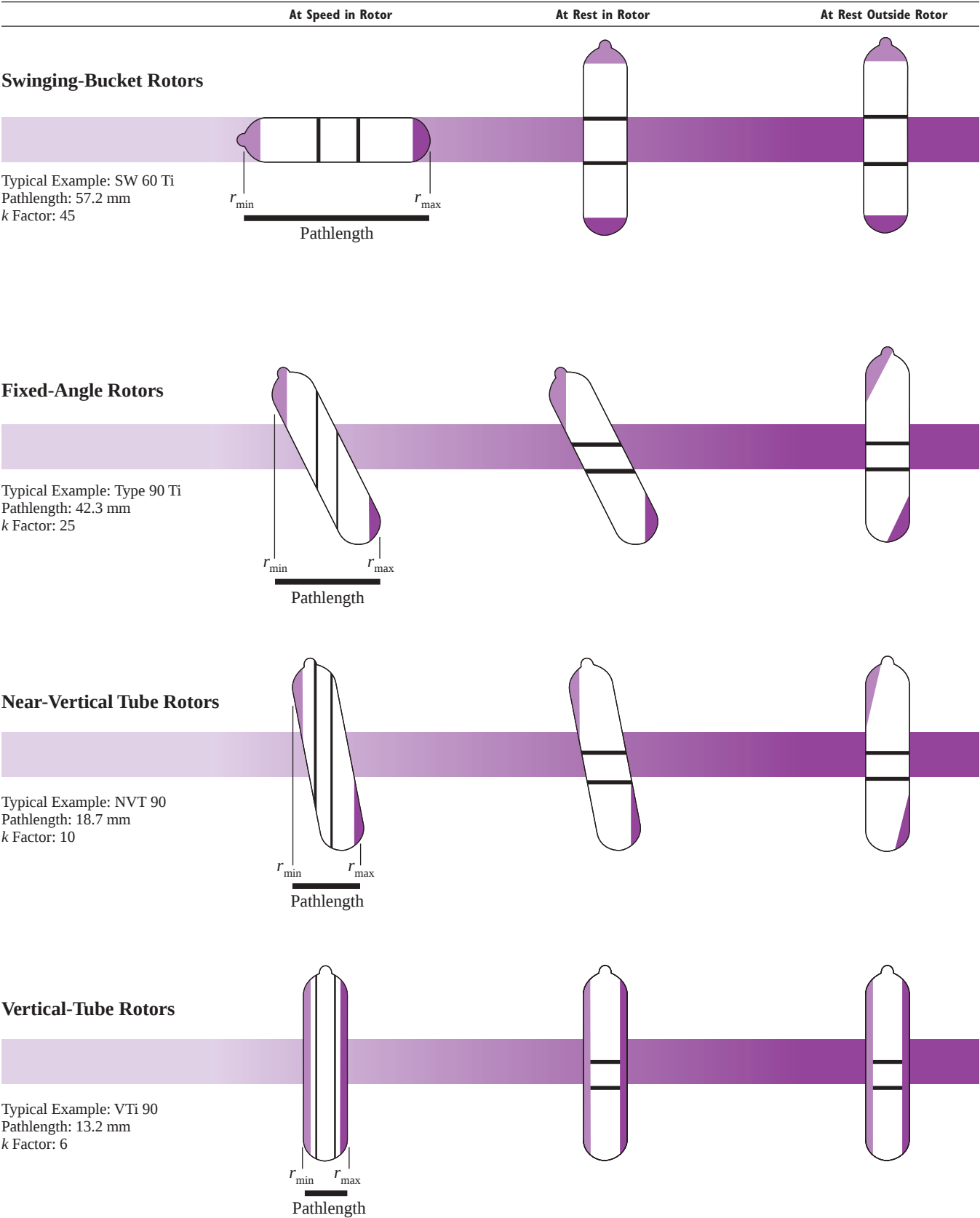
NVT™ Near-Vertical Tube Rotors

NVT Near-Vertical Tube Rotors, a patented Beckman Coulter innovation, were designed specifically for density gradient separations. Their narrow angle of less than 10° is calculated using a proprietary algorithm which determines the optimal angle for each rotor, taking into consideration specific tube geometries. These angles result in significantly reduced run times compared with conventional Fixed-Angle Rotors, while positioning pelleted and floated components at the ends of the tubes, away from the bands of interest.

Continuous-Flow/Zonal Rotors

These rotors are capable of processing large sample volumes in their cores. This large-scale processing ability is clearly evident in Continuous-Flow Rotors, which can process a typical 10-liter sample in about four hours, instead of the 12–24 hours required by conventional methods. Zonal Rotors have similar utility in large-scale density gradient separations.

Particle Separation in Swinging-Bucket, Fixed-Angle, Near-Vertical Tube, and Vertical-Tube Rotors



Dark purple represents pelleted material, light purple depicts floating components, and bands are indicated by black lines.

Preparative Ultracentrifuge Rotor Recommendations for Key Applications

Selection Criteria	Recommended Rotors
Separation of Subcellular Particles and Viruses	
Largest Volume for Pelleting:	Type 100 Ti, Type 90 Ti, Type 70 Ti, Type 50.2 Ti, Type 45 Ti, TLA-100.3, MLA-80
Fastest Rate-zonal Separation:	MLN-80, SW 60 Ti, SW 55 Ti, SW 41 Ti, VTi 90, TLS-55, TLV-100
Largest Volume Rate-zonal Separation:	SW 28, VTi 50
Rate-Zonal Separation of Proteins in a Sucrose Gradient	
Fastest Separation:	VTi 90, VTi 65.2, TLV-100
Largest Volume:	VTi 50
Greatest Number of Samples:	VTi 65.2, NVT 65.2
Greatest Interband Distance:	SW 60 Ti, SW 55 Ti, SW 41 Ti, MLS-50
Separation of Lipoproteins	
Fastest Differential Flotation:	Type 100 Ti, Type 90 Ti, Type 70.1 Ti, MLA-130, TLA-110, TLA-100.3
Greatest Number of Samples for Differential Flotation:	Type 50.4 Ti, Type 42.2 Ti, MLA-130, TLA-120.1
Largest Volume for Differential Flotation:	Type 70 Ti, Type 50.2 Ti
Greatest Interband Distance for Density Gradient Separation:	SW 60 Ti, SW 55 Ti, SW 41 Ti, MLS-50
Fastest Density Gradient Separation:	VTi 90, VTi 50, MLV-80, TLV-100, TLA-120.2
Pelleting RNA through a CsCl Gradient	
Fastest Separation:	SW 60 Ti, SW 55 Ti, MLS-50
Largest Volume:	SW 41 Ti, SW 28.1
Isopycnic Separation of Plasmid DNA	
Fastest Separation:	NVT 90, VTi 90, NVT 65, NVT 65.2, VTi 65.2, MLA-130, TLN-100
Greatest Interband Distance:	Type 100 Ti, Type 90 Ti, Type 70.1 Ti, TLA-110, MLA-80
Largest Volume:	VTi 50, MLA-80, TLA-110

Gradient Materials

There is no ideal all-purpose gradient material. Sucrose is used for most rate separations and cesium chloride is often used for isopycnic separations. The basic requirement is that the gradient permits the desired type of separation. Additional considerations in selecting a gradient material include the following:

- Its density range should be sufficient to permit separation of the particles of interest by the chosen density gradient technique, without overstressing the rotor.
- It should not affect the biological activity of the sample.
- It should be neither hyperosmotic nor hypoosmotic when the sample is composed of sensitive organelles.
- It should not interfere with the assay technique.
- It should be removable from the purified product.
- It should not absorb in the ultraviolet or visible range.
- It should be inexpensive and readily available; more expensive materials should be recoverable for reuse.
- It should be sterilizable.
- It should not be corrosive to the rotor, particularly for zonal or continuous-flow operation.
- It should not be flammable or toxic to the extent that its aerosols could be hazardous.

The following tables are provided as a reference for information on commonly used gradient materials.

Commonly Used Gradient Materials with Their Solvents

Materials	Solvent	Maximum Density at 20°C
Sucrose (66%)	H ₂ O	1.32
Sucrose (65%)	D ₂ O	1.37
Silica sols	H ₂ O	1.30
Diodon	H ₂ O	1.37
Glycerol	H ₂ O	1.26
Cesium chloride	H ₂ O	1.91
	D ₂ O	1.98
Cesium formate	H ₂ O	2.10
Cesium acetate	H ₂ O	2.00
Rubidium chloride	H ₂ O	1.49
Rubidium formate	H ₂ O	1.85
Rubidium bromide	H ₂ O	1.63
Potassium acetate	H ₂ O	1.41
Potassium formate	H ₂ O	1.57
	D ₂ O	1.63
Sodium formate	H ₂ O	1.32
	D ₂ O	1.40
Lithium bromide	H ₂ O	1.83
Lithium chloride	D ₂ O	1.33
Albumin	H ₂ O	1.35
Sorbitol	H ₂ O	1.39
Ficoll	H ₂ O	1.17
Metrizamide	H ₂ O	1.46

Density, Refractive Index, and Concentration Data—Cesium Chloride at 25°C Molecular Weight = 168.37

Density (g/cm ³)*	Refractive Index, n_D	% by Weight	mg/ml of Solution**	Molarity	Density (g/cm ³)*	Refractive Index, n_D	% by Weight	mg/ml of Solution**	Molarity
1.0047	1.3333	1	10.0	0.056	1.336	1.3657	34	454.2	2.698
1.0125	1.3340	2	20.2	0.119	1.3496	1.3670	35	472.4	2.806
1.0204	1.3348	3	30.6	0.182	1.363	1.3683	36	490.7	2.914
1.0284	1.3356	4	41.1	0.244	1.377	1.3696	37	509.5	3.026
1.0365	1.3364	5	51.8	0.308	1.391	1.3709	38	528.6	3.140
1.0447	1.3372	6	62.8	0.373	1.406	1.3722	39	548.3	3.257
1.0531	1.3380	7	73.7	0.438	1.4196	1.3735	40	567.8	3.372
1.0615	1.3388	8	84.9	0.504	1.435	1.3750	41	588.4	3.495
1.0700	1.3397	9	96.3	0.572	1.450	1.3764	42	609.0	3.617
1.0788	1.3405	10	107.9	0.641	1.465	1.3778	43	630.0	3.742
1.0877	1.3414	11	119.6	0.710	1.481	1.3792	44	651.6	3.870
1.0967	1.3423	12	131.6	0.782	1.4969	1.3807	45	673.6	4.001
1.1059	1.3432	13	143.8	0.854	1.513	1.3822	46	696.0	4.134
1.1151	1.3441	14	156.1	0.927	1.529	1.3837	47	718.6	4.268
1.1245	1.3450	15	168.7	1.002	1.546	1.3852	48	742.1	4.408
1.1340	1.3459	16	181.4	1.077	1.564	1.3868	49	766.4	4.552
1.1437	1.3468	17	194.4	1.155	1.5825	1.3885	50	791.3	4.700
1.1536	1.3478	18	207.6	1.233	1.601	1.3903	51	816.5	4.849
1.1637	1.3488	19	221.1	1.313	1.619	1.3920	52	841.9	5.000
1.1739	1.3498	20	234.8	1.395	1.638	1.3937	53	868.1	5.156
1.1843	1.3508	21	248.7	1.477	1.658	1.3955	54	895.3	5.317
1.1948	1.3518	22	262.9	1.561	1.6778	1.3973	55	922.8	5.481
1.2055	1.3529	23	277.3	1.647	1.699	1.3992	56	951.4	5.651
1.2164	1.3539	24	291.9	1.734	1.720	1.4012	57	980.4	5.823
1.2275	1.3550	25	306.9	1.823	1.741	1.4032	58	1009.8	5.998
1.2387	1.3561	26	322.1	1.913	1.763	1.4052	59	1040.2	6.178
1.2502	1.3572	27	337.6	2.005	1.7846	1.4072	60	1070.8	6.360
1.2619	1.3584	28	353.3	2.098	1.808	1.4093	61	1102.9	6.550
1.2738	1.3596	29	369.4	2.194	1.831	1.4115	62	1135.8	6.746
1.2858	1.3607	30	385.7	2.291	1.856	1.4137	63	1167.3	6.945
1.298	1.3619	31	402.4	2.390	1.880	1.4160	64	1203.2	7.146
1.311	1.3631	32	419.5	2.492	1.9052	1.4183	65	1238.4	7.355
1.324	1.3644	33	436.9	2.595					

Density data are from International Critical Tables.

*Computed from the relationship $p_{25} = 10.2402 \text{ hD}_{25} - 12.6483$ for densities between 1.00 and 1.38, and $p_{25} = .0.8601 \text{ hD}_{25} - 13.4974$ for densities above 1.37 (Bruner and Vinograd, 1965).

**Divide by 10.0 to obtain % w/v.

Density, Refractive Index, and Concentration Data – Sucrose at 20°C, Molecular Weight = 342.3

Density (g/cm ³)	Refractive Index, n_D	% by Weight	mg/ml of Solution*	Molarity	Density (g/cm ³)	Refractive Index, n_D	% by Weight	mg/ml of Solution*	Molarity
0.9982	1.3330	0			1.1463	1.3883	34	389.7	1.138
1.0021	1.3344	1	10.0	0.029	1.1513	1.3902	35	403.0	1.177
1.0060	1.3359	2	20.1	0.059	1.1562	1.3920	36	416.2	1.216
1.0099	1.3374	3	30.3	0.089	1.1612	1.3939	37	429.6	1.255
1.0139	1.3388	4	40.6	0.119	1.1663	1.3958	38	443.2	1.295
1.0179	1.3403	5	50.9	0.149	1.1713	1.3978	39	456.8	1.334
1.0219	1.3418	6	61.3	0.179	1.1764	1.3997	40	470.6	1.375
1.0259	1.3433	7	71.8	0.210	1.1816	1.4016	41	484.5	1.415
1.0299	1.3448	8	82.4	0.211	1.1868	1.4036	42	498.5	1.456
1.0340	1.3464	9	93.1	0.272	1.1920	1.4056	43	512.6	1.498
1.0381	1.3479	10	103.8	0.303	1.1972	1.4076	44	526.8	1.539
1.0423	1.3494	11	114.7	0.335	1.2025	1.4096	45	541.1	1.581
1.0465	1.3510	12	125.6	0.367	1.2079	1.4117	46	555.6	1.623
1.0507	1.3526	13	136.6	0.399	1.2132	1.4137	47	570.2	1.666
1.0549	1.3541	14	147.7	0.431	1.2186	1.4158	48	584.9	1.709
1.0592	1.3557	15	158.9	0.464	1.2241	1.4179	49	599.8	1.752
1.0635	1.3573	16	170.2	0.497	1.2296	1.4200	50	614.8	1.796
1.0678	1.3590	17	181.5	0.530	1.2351	1.4221	51	629.9	1.840
1.0721	1.3606	18	193.0	0.564	1.2406	1.4242	52	645.1	1.885
1.0765	1.3622	19	204.5	0.597	1.2462	1.4264	53	660.5	1.930
1.0810	1.3639	20	216.2	0.632	1.2519	1.4285	54	676.0	1.975
1.0854	1.3655	21	227.9	0.666	1.2575	1.5307	55	691.6	2.020
1.0899	1.3672	22	239.8	0.701	1.2632	1.4329	56	707.4	2.067
1.0944	1.3689	23	251.7	0.735	1.2690	1.4351	57	723.3	2.113
1.0990	1.3706	24	263.8	0.771	1.2748	1.4373	58	739.4	2.160
1.1036	1.3723	25	275.9	0.806	1.2806	1.4396	59	755.6	2.207
1.1082	1.3740	26	288.1	0.842	1.2865	1.4418	60	771.9	2.255
1.1128	1.3758	27	300.5	0.878	1.2924	1.4441	61	788.3	2.303
1.1175	1.3775	28	312.9	0.914	1.2983	1.4464	62	804.9	2.351
1.1222	1.3793	29	325.4	0.951	1.3043	1.4486	63	821.7	2.401
1.1270	1.3811	30	338.1	0.988	1.3103	1.4509	64	838.6	2.450
1.1318	1.3829	31	350.9	1.025	1.3163	1.4532	65	855.6	2.500
1.1366	1.3847	32	363.7	1.063	1.3224	1.4558	66	872.8	2.550
1.1415	1.3865	33	376.7	1.100	1.3286	1.4581	67	890.2	2.864

Density and refractive index data are from the International Critical Tables.

*Divide by 10.0 to obtain % w/v.

Density Conversion for Cesium and Rubidium Salts at 20°C

% w/w	CsCl	CsBr	CsI	Cs ₂ SO ₄	CsNO ₃	RbCl	RbBr	RbI	Rb ₂ SO ₄	RbNO ₃
1	1.00593	1.00612	1.00608	1.0061	1.00566	1.00561	1.00593	1.00591	1.0066	1.0053
2	1.01374	1.01412	1.01402	1.0144	1.01319	1.01307	1.01372	1.01370	1.0150	1.0125
4	1.02969	1.03048	1.03029	1.0316	1.02859	1.02825	1.02965	1.02963	1.0322	1.0272
6	1.04609	1.04734	1.04707	1.0494	1.04443	1.04379	1.04604	1.04604	1.0499	1.0422
8	1.06297	1.06472	1.06438	1.0676	1.06072	1.05917	1.06291	1.06296	1.0680	1.0575
10	1.08036	1.08265	1.08225	1.0870	1.07745	1.07604	1.08028	1.08041	1.0864	1.0731
12	1.09828	1.10116	1.10071	1.1071	1.09463	1.09281	1.09817	1.09842	1.1052	1.0892
14	1.11676	1.12029	1.11979	1.1275	1.11227	1.11004	1.11661	1.11701	1.1246	1.1057
16	1.13582	1.14007	1.13953	1.1484		1.12775	1.13563	1.13621	1.1446	1.1227
18	1.15549	1.16053	1.15996	1.1696		1.14596	1.15526	1.15605	1.1652	1.1401
20	1.17580	1.18107	1.18112	1.1913		1.16469	1.17554	1.17657	1.1864	1.1580
22	1.19679	1.20362	1.20305	1.2137		1.18396	1.19650	1.19781	1.2083	1.1763
24	1.21849	1.22634	1.22580	1.2375		1.20379	1.21817	1.21980	1.2309	1.1952
26	1.24093	1.24990	1.24942	1.2643		1.22421	1.24059	1.24257	1.2542	1.2146
28	1.26414	1.27435	1.27395			1.24524	1.26380	1.26616	1.2782	1.2346
30	1.28817	1.29973	1.29944			1.26691	1.28784	1.29061	1.3028	1.2552
35	1.35218	1.36764	1.36776			1.32407	1.35191	1.35598	1.3281	1.2764
40	1.42245	1.44275	1.44354			1.38599	1.42233	1.42806		
45	1.49993	1.52626	1.52803			1.45330	1.50010	1.50792		
50	1.58575	1.61970	1.62278			1.52675	1.58639	1.59691		
55	1.68137	1.72492					1.68254	1.69667		
60	1.78859							1.80924		
65	1.90966							1.93722		

Useful Formulas

k Factor

To determine *k* factor

$$k = \frac{\ln(r_{\max}/r_{\min})}{\omega^2} \times \frac{10^{-13}}{3600} \quad \text{OR} \quad k = \frac{2.53 \times 10^5 \ln(r_{\max}/r_{\min})}{(\text{rpm}/1000)^2}$$

To determine pelleting time (*t*)

$$t = \frac{k}{s} \quad \text{where } s = \text{sedimentation coefficient in Svedbergs}$$

To relate pelleting time between rotors

$$\frac{k_1}{t_1} = \frac{k_2}{t_2}$$

To adjust *k* factor for runs less than maximum rotor speed

$$k_{\text{adj}} = k \left(\frac{\text{maximum rated speed of rotor}}{\text{actual run speed}} \right)^2$$

To relate relative centrifugal force (RCF) to speed (rpm):

$$\text{RCF}_{\max} = 1.12 r_{\max} \left(\frac{\text{rpm}}{1000} \right)^2 \quad \text{OR} \quad \text{rpm} = 10^3 \sqrt{\frac{\text{RCF}}{1.12 r_{\max}}}$$

To relate the sedimentation coefficient (*s*) to rotational speed:

$$s = \frac{dr}{dt} \times \frac{1}{\omega^2 r}$$

Svedberg unit (S) equivalent:

$$S = 10^{-13} \text{ seconds}$$

Reduced run speed for dense solutions:

$$\text{reduced run speed} = \text{max rated speed of rotor} \times \sqrt{A/B}$$

where *A* = max. permissible density of rotor tube contents, and
B = actual density of the tubes to be centrifuged

Support Services

Field Service Support

Most of us appreciate the need for careful design, handling, and maintenance of certain kinds of laboratory equipment—the optics of a spectrophotometer, for example. It may not be obvious, however, that anything as substantial looking as a centrifuge rotor must be properly maintained during use in order for it to fulfill its life expectancy.

If you consider that, during rotation, an Ultracentrifuge Rotor may experience more than 800,000 times the force of gravity, it becomes apparent that seemingly minor flaws will assume much greater significance at these *g*-forces. In effect, one gram will “weigh” 800 kilograms, and a tiny flaw in a critical part may generate stresses greater than the rotor was designed to withstand.

We at Beckman Coulter maintain stringent quality standards and rigorously test every rotor design. Specific instructions for care and maintenance are included in the rotor manual that accompanies each rotor. And our Field Rotor Inspection Program is available at no charge to all users of Beckman Coulter Ultracentrifuges and High-Speed Centrifuges.

Field Rotor Inspection Program. What Is It?

Our Field Rotor Inspection Program (FRIP) has two purposes: to prevent premature rotor failures by detection of stress corrosion, metal fatigue, wear or damage to anodized coatings; and to instruct laboratory personnel in the proper care of rotors.

Contact your local Beckman Coulter Service Office for details on the Field Rotor Inspection Program. Using nondestructive methods (fiber optics borescopy and dye-penetrant analysis), they may find signs of corrosion or other damage. If so, they will recommend repair or replacement, and a potentially costly failure may be prevented.

To give a fuller understanding of rotors, a comprehensive slide presentation is also offered. Centrifuge users are informed about maintenance procedures, rotor damage, and its significance. The stress corrosion of aluminum rotors, in particular, can be greatly reduced by good laboratory practice.

Sometimes rotor corrosion is so bad it can be seen by the naked eye, while at other times it is not so apparent. If you have doubt about the condition of a single Beckman Coulter rotor, you may return it to the factory where it will be

inspected free of charge by our metallurgists. The rotor will be examined by a variety of nondestructive methods, including ultrasound which is capable of detecting internal flaws. Before shipping the rotor, you must contact the nearest Beckman Coulter Sales and Service office for specific instructions. A written statement must accompany each rotor, indicating that it is safe to handle, (*i.e.* free of any pathogenic or radioactive contamination).

Rotor Safety Seminars

To help you get the most from your Beckman Coulter rotors, Rotor Safety Seminars are frequently presented by our Field Service engineers. Seminars are designed to remind centrifuge users about the importance of proper rotor care and maintenance.

When you attend a Beckman Coulter Rotor Safety Seminar, you will have an opportunity to ask questions that are specific to your particular situation, and you will learn:

- What causes corrosion in a rotor, where it starts, what it does to the rotor, and how to avoid it
- The proper way to clean and store rotors
- How to get longer life from your rotor

On-Site Rotor Inspection and Maintenance

Specially trained Beckman Coulter Field Service engineers are available at your request for on-site inspection and minor rotor maintenance. Rotors that are free of biological and radiological contamination can be brought to these sessions for immediate inspection so you can continue operating your centrifuge with confidence in the condition of your rotors.

A Comprehensive Approach to Centrifuge System Care

Throughout the world, Beckman Coulter Field Service engineers are on hand to provide the support you need. So you can operate your centrifuges worry-free, a number of programs are in place that cover preventive maintenance of your system, including parts, labor, drive systems, and rotors. It all adds up to a comprehensive approach to maximizing your system investment.

Contact your local Beckman Coulter Sales and Service office to find out the specifics about the program available in your area.