BR-8101D

BECKMAN COULTER

*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:* Biosafety

*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.*

***Ordering is Easy***
***Simply Call***
***1-800-742-2345 (USA)***

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# Ultracentrifugation

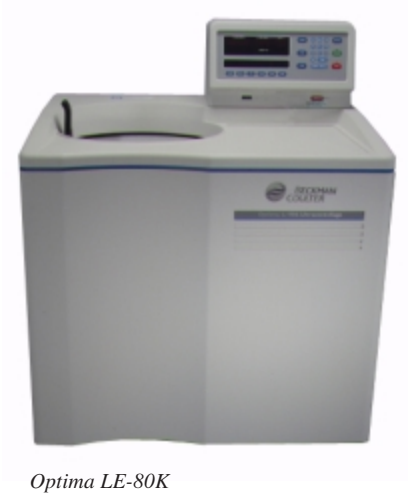


*The Beckman Coulter line of ultracentrifuges covers the full range of applications, with the Optima™ series leading the way. The Optima series, with the convenience and reliability of an imbalance-tolerant drive, ushered in a new era in ultracentrifugation. It offers freon-free temperature control,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

## Optima™ K-Series – *In a Class By Itself*

*Optima XL-100K*

*Optima L-90K*



*Optima LE-80K*

*For more information on preparative floor and benchtop Optima series ultracentrifuges, order bulletin BR 8108.*

- 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 XL K-Series performs common calculations such as CsCl speed reductions, run conversions, and more.
- ESP™ Efficient Sedimentation Program predicts precipitation of heavy salts, and avoids it to optimize run times.
- Optima benchtop 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

Biosafety

- Compact benchtop models are sized for operation within laminar flow hoods.

### Preparative Floor Models

| | Part No. UL/CSA 200/240 VAC 60 Hz | Part No. CE Marking 220/240 VAC 50 Hz | Max. Speed (rpm) | Max. g-force |
|---|---|---|---|---|
| Optima XL-100K | 365669 | 365671 | 100,000 | 802,400 |
| Optima XL-80K | 365665 | 365666 | 80,000 | 602,000 |
| Optima L-90K | 365670 | 365672 | 90,000 | 694,000 |
| Optima L-70K | 365677 | 365678 | 70,000 | 504,000 |
| Optima LE-80K | 365667 | 365668 | 80,000 | 602,000 |

For factory-installed modifications for operation with either the CF-32 or Ti 15 rotor, order the following:

| Optima Instrument | Voltage and Hz | Standard Instrument | Modified for CF-32 Ti* | Modified for Ti 15† |
|---|---|---|---|---|
| XL-100K | 200-240/60 | 365669 | 350883 | 350918 |
| | 220-240/50 | 365671 | 350912 | 350919 |
| XL-80K | 200-240/60 | 365665 | 350913 | 350920 |
| | 220-240/50 | 365666 | 350914 | 350921 |
| L-90K | 200-240/60 | 365670 | 350909 | 350922 |
| | 220-240/50 | 365672 | 350908 | 350923 |
| L-70K | 200-240/60 | 365677 | 350911 | 350924 |
| | 220-240/50 | 365678 | 350910 | 350925 |
| LE-80K | 200-240/60 | 365667 | Not Available | Not Available |
| | 220-240/50 | 365668 | Not Available | Not Available |

* Factory modification includes modified standoffs, modified drive mounts, vacuum door, door cover, aspirator vacuum pump, and adapter bowl (does not include rotor).
† Factory modification includes modified standoffs and modified drive mounts (does not include rotor).

## Optima™ MAX/MAX-E

*Optima MAX*

### High-Capacity Personal Ultracentrifuges

| | UL/CSA/CE Marking | Part No. | Max. Speed (rpm) | Max. g-force |
|---|---|---|---|---|
| Optima MAX | 220/240 VAC, 50 Hz | 364300 | 120,000 | 1,019,000 |
| | 110 VAC, 60 Hz | 364301 | 120,000 | 1,019,000 |
| | 100 VAC, 50/60 Hz | 364302 | 120,000 | 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*

### Preparative Benchtop Models

| | UL/CSA/CE Marking | 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 |

# Ultracentrifugation



## Airfuge® Ultracentrifuge

*Airfuge 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 Ultracentrifuge Without Digital Tachometer

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

### Airfuge Ultracentrifuge With Digital Tachometer

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

*For more information on the Airfuge Ultracentrifuge, order bulletin DS-8042.*

# Solution Interaction Analysis (sIA)

## Analytical Ultracentrifuge

*Optima XL-I*

The Optima™ XL-A and XL-I provide comprehensive characterization of macromolecular behavior in solution. Windows*-based analysis software simplifies the task of modeling the association behavior of macromolecules and makes the technique of sedimentation analysis available to the novice and expert alike.

The Optima XL-A is equipped with a scanning UV/VIS dectection system. The Optima XL-I is equipped with both the scanning UV/VIS and Rayleigh interference detection systems. Options are available to upgrade the XL-A to add interference optics.

- Protein aggregation studies
- Exploration of self-association and viral assembly processes
- Protein stability
- Site mutation effects on protein folding

### Analytical Ultracentrifuge

| | Part No. UL/CSA 200/240 VAC 60 Hz | CE Marking 220/240 VAC 50 Hz | Max. Speed (rpm) | Max. g-force |
|---|---|---|---|---|
| Optima XL-A | 364009 | 364080 | 70,000 | 504,000 |
| Optima XL-I | 363980 | 363979 | 70,000 | 504,000 |

*For more information on analytical Optima XL-A and XL-I, order bulletin DS-8107.*

** Windows is a registered trademark of the Microsoft Corporation.*

### 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.

Before ordering a rotor, check the decal on your instrument to make certain it will accommodate the rotor selected. The Optima™ XL ultracentrifuges are classified "S" and 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 Bulletin. 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, it will be replaced free of charge. Address request to:

Technical Publication Department
Beckman Coulter, Inc.
1050 Page Mill Road
Palo Alto, CA 94304 USA

### Rotor Designations

All Beckman Coulter fixed-angle, preparative 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 this bulletin 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

| Rotor | Model L | | L2-50 | | | L2-65 | | L2-65/75B | L3-40/50 | | L4 | L7 | L5/L5B/L8/L8M | Optima™ L/LE | | Optima XL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | F | D | F | G | F | G | Q | R | H | R | S | 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 | | | | | | | | | | | | ● | ● | ● | ● | ● |
| Type 15 | | | ● | ● | ● | ● | ● | ● | ● | ● | | | | | | ● |
| NVT 100 | | | | | | | | † | | † | | ● | ● | ● | ● | ● |
| NVT 90 | | | | | | | | † | | † | | ● | ● | ● | ● | ● |
| NVT 65.2 | | | | | | | | † | | † | | ● | ● | ● | ● | ● |
| NVT 65 | | | | | | | | † | | † | | ● | ● | ● | ● | ● |
| VTi 90 | | | | | | | | † | | † | | ● | ● | ● | ● | ● |
| VTi 80 | | | | | | | | † | | † | | ● | ● | ● | ● | ● |
| VTi 65.1 | | | | | | | | † | | † | | ● | ● | ● | ● | ● |
| VTi 65.2 | | | | | | | | † | | † | | ● | ● | ● | ● | ● |
| VTi 65 | | | | | | | | † | | † | | ● | ● | ● | ● | ● |
| VTi 50 | | | | | | | | † | | † | | ● | ● | ● | ● | ● |

** Can only be used in these instruments if they have been upgraded with a diffusion pump and vacuum indicator.*

*† Contact CDC/Palo Alto Marketing for waiver letter explaining use without slow start capabilities.*

## Quick-Reference Guide to Instrument Classification Rotor Compatibility (cont'd)

| Rotor | Model L | | L2-50 | | | L2-65 | | L2-65/75B | L3-40/50 | | L4 | L7 | L5/L5B/L8/L8M | Optima L | | Optima XL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | F | D | F | G | F | G | Q | R | H | R | S | S |
| VC 53 | | | | | | | | † | | † | | ● | ● | ● | ● | ● |
| VAC 50 | | | | | | | | † | | † | | ● | ● | ● | ● | ● |
| SW 65 Ti | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| SW 60 Ti | | | | | | | | ● | | ● | | ● | ● | ● | ● | ● |
| SW 55 Ti | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| SW 56 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| SW 50.1 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| SW 41 Ti | | | | | | | | ● | ● | ● | | ● | ● | ● | ● | ● |
| SW 40 Ti | | | ● | ● | ● | ● | ● | ● | | ● | | ● | ● | ● | ● | ● |
| SW 50 L | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| SW 39 L | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| SW 36 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| SW 30.1 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ● | ● | ● |
| SW 30 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ● | ● | ● |
| SW 28.1 | | | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ● | ● | ● |
| SW 28 | | | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ● | ● | ● |
| SW 27.1 | | | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ● | ● | ● |
| SW 27 | | | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ● | ● | ● |
| SW 25.2 | | | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ● | ● | ● |
| SW 25.1 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| CF 32 Ti | | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | ● | | ● | ● |
| Z 60 | | | | | ● | | ● | ● | ● | ● | | | ● | | ● | ● |
| Ti 15 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | ● | ● |
| Ti 14 | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | | ● | ● |

*Note: Preparative rotors listed above are not compatible with XL-A Analytical Ultracentrifuge.*
*The following rotors are compatible only with Optima™ XL-A and XL-I: An 60 Ti, An 50 Ti (classified T).*

# Beckman Coulter Floor Model Ultracentrifuge Rotors by Use



### 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 | FGHRS |
| **NVT 100** | 100,000 | 750,000 | 8 | 13 x 51 | 40.8 | RS |
| **Type 90 Ti** | 90,000 | 694,000 | 25 | 8 x 13.5 | 108 | FGHRS |
| **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 | F[2]G[3]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 | FGHRS |
| **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 | F[2]G[3]HRS |
| **Type 55.2 Ti** | 55,000 | 340,000 | 64 | 10 x 39 | 390 | GHRS |
| **Type 50.2 Ti** | 50,000 | 302,000 | 69 | 12 x 39 | 468 | FGHRS |
| **VTi 50** | 50,000 | 242,000 | 36 | 8 x 39 | 312 | HRS |
| **Type 45 Ti** | 45,000 | 235,000 | 133 | 6 x 94 | 564 | FGHQRS |

### Rotors for Differential Flotation

| | | | | | | |
|---|---|---|---|---|---|---|
| **Type 50.4 Ti** | 50,000 | 270,000 | 39 | 44 x 6.5 | 286 | FGHRS |
| **Type 42.2 Ti** | 42,000 | 223,000 | 9 | 72 x 230 | 76.5 | GHRS |
| **Type 25** | 25,000 | 92,500 | 62 | 100 x 1 | 100 | CDFGHRS |

### Rotor for Concentrating Large Particles in Volume

| | | | | | | |
|---|---|---|---|---|---|---|
| **Type 19** | 19,000 | 53,900 | 951 | 6 x 250 | 1500 | HRS |

### Rotors for Isopycnic and Rate-Zonal Gradients

| | | | | | | |
|---|---|---|---|---|---|---|
| **SW 60 Ti** | 60,000 | 485,000 | 45 | 6 x 4 | 24 | GHRS |
| **SW 55 Ti** | 55,000 | 368,000 | 48 | 6 x 5.0 | 30 | BCDFGHQRS |

### Rotor with Long, Slender Tubes for Rate-Zonal Gradients

| | | | | | | |
|---|---|---|---|---|---|---|
| **SW 28.1** | 28,000 | 150,000 | 276 | 6 x 17 | 102 | CDFGHRS |

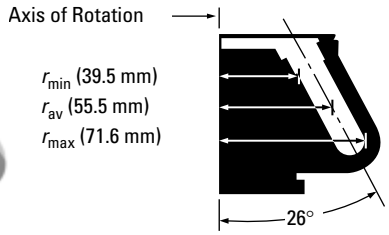
### Rotor for Larger-Volume Density Gradients

| | | | | | | |
|---|---|---|---|---|---|---|
| **SW 28** | 28,000 | 141,000 | 245 | 6 x 39 | 234 | CDFGHRS |

### 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 | BCDFGHS |
| **Ti-15** | 32,000 | 102,000 | 1,675 | 50-200 | >100 | BCDFGHQS |
| **Ti-14** | 48,000 | 172,000 | 665 | 20-50 | 20-100 | BCDFGHQS |

[1] *Smaller volume tubes may also be used with adapters and/or spacers. Check the rotor listing for more information.*
[2] *Class F, Model L2-50 and Model L3s only.* [3] *Class G, Model L3s only.*




## Fixed-Angle Rotor, Titanium

For use in instruments classified: **F G 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<br>½ x 2 ½ in<br>13 x 64 mm | 54 mL |

**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, 12 each 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

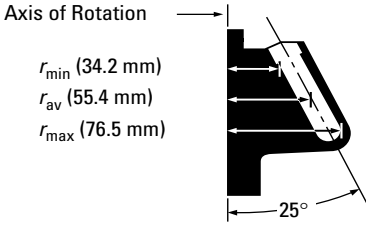
839347 O-ring for Rotor Handle
363304 Overspeed Disk, 100,000 rpm
363039 Rotor Handle
876089 O-ring for Rotor Lid

### Spacers (Package of 8)

365470 fits 13 x 64 mm
360270 fits 13 x 51 mm
fits 13 x 32 mm
fits 13 x 25 mm

### Adapters/Spacers/Caps

360270 362307 365470




## Fixed-Angle Rotor, Titanium

For use in instruments classified: **F G 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<br>⅝ x 3 in<br>16 x 76 mm | 108 mL |

**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.)

**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 section.)

**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.*

[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.*

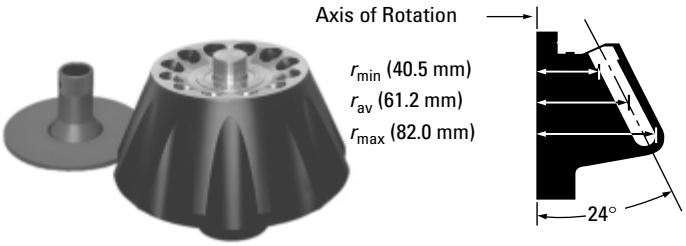
*Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.*

### Rotor Replacement Parts

839347 O-ring for Rotor Handle
356959 Tool, handle
355539 Overspeed Disk, 90,000 rpm
364392 Rotor Handle
876089 O-ring for Rotor Lid
355528 Rotor Lid

### Adapters/Spacers/Caps

303313 303376 303401 303402 303624 338907 341968 346256 342695 344676 345828 361670




## Fixed-Angle Rotor, Titanium

For use in instruments classified: **F[1] G[2] 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<br>⅝ x 3 in<br>16 x 76 mm | 162 mL |

**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.)

**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 section.)

**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 |

*[1] Class F, Model L2-50 and Model L3's only.*
*[2] Class G, Model L3's only.*

**Set of 2.*

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

*† 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.*

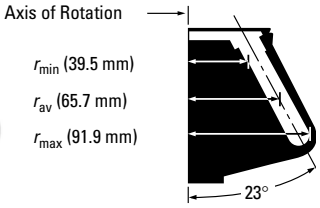
*Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.*

### 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

303313 303376 303401 303402 303624 341968 342695 344676 345828 346256 361670




## Fixed-Angle Rotor, Titanium

For use in instruments classified: **F[1] G[2] 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<br>1 x 3 ½ in<br>25 x 89 mm | 312 mL |

**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.)

**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 section.)

**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 |

*[1]Class F, Model L2-50 and Model L3s only.* *[2]Class G, Model L3s only.*

*[a] Set of two.*

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

*[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.*

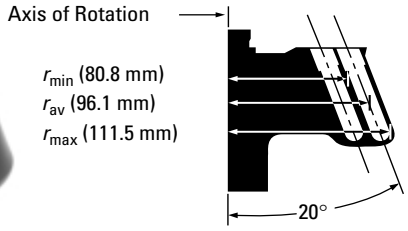
*Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.*

### 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

303307 303392 330860 331151 337927 338906 338907 342699 343448 344635 346256 361669




## Fixed-Angle Rotor, Titanium

For use in instruments classified: **F G 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<br>312,000 | 39<br>33 | 44 x 6.5 mL<br>½ x 2½ in<br>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 | 45,00 |

** Set of 2.*

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

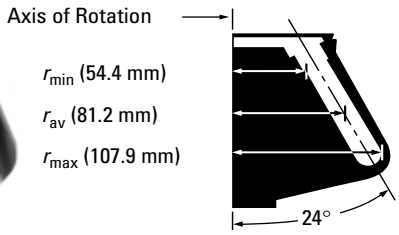
*Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.*

### 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

303113 303823 303658 344389 345827 346256 361676




## Fixed-Angle Rotor, Titanium

For use in instruments classified: **F G 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<br>1 x 3½ in<br>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 section.)

**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 |

** Set of two.*

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

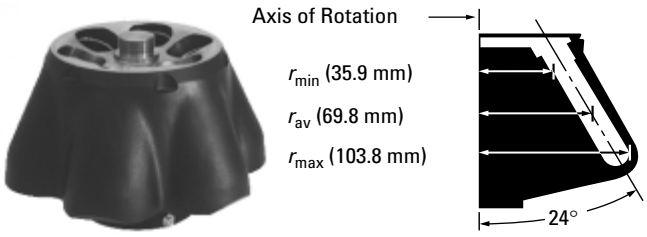
*† Caps are optional for these thickwall tubes. In the Type 50.2 Ti, the filling level for 355642 and 355631 is 16.5 mL. For 355640 and 355630, the filling level is 8 mL. Maximum speeds for these open-top tubes without a cap: Polycarbonate — 45,000 rpm. Polyallomer — 20,000 rpm. These speeds are those 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.*

*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
834301 Large O-ring for Rotor Lid
335158 Mechanical Overspeed Device, 50,000 rpm
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: **F G H Q 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<br>1½ x 4 in<br>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 section.)

### 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** | 355622* | 6 | 70.0 | 38 x 102 | ——— | ——— | 235,000 | 133 | 45,000† |
| **Bottle/Assembly** | 355651** | 6 | 10.4 | 16 x 76 | ——— | ——— | 397,000 | 43 | 65,000 |
| **Thinwall** | 345775 | 25 | 94.0 | 38 x 102 | 330901 | ——— | 235,000 | 133 | 45,000 |
| **Polyallomer** | 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** | 355643 | 25 | 81.0 | 38 x 102 | 338905† | ——— | 235,000 | 133 | 45,000 |
| **Polyallomer** | 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** | 355628 | 25 | 81.0 | 38 x 102 | 338905† | ——— | 235,000 | 133 | 45,000 |
| **Polycarbonate** | 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** | 345777 | 25 | 94.0 | 38 x 102 | 330901 | ——— | 235,000 | 133 | 45,000 |
| **Ultra-Clear** | 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).*

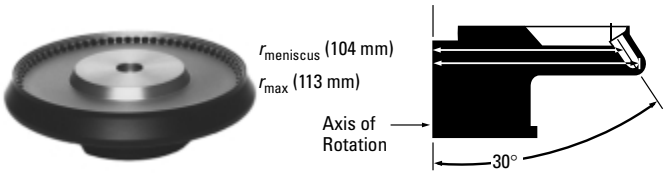
*** Bottle only. Reduce speed to 35,000 rpm when the bottle is centrifuged less than full (minimum fill volume is 35 mL).*

*† 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
335657 Mechanical Overspeed Device, 45,000 rpm
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: **G 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 x 230 µL<br>.29 x .8 in<br>7 x 20 mm | 16.5 mL |

**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.

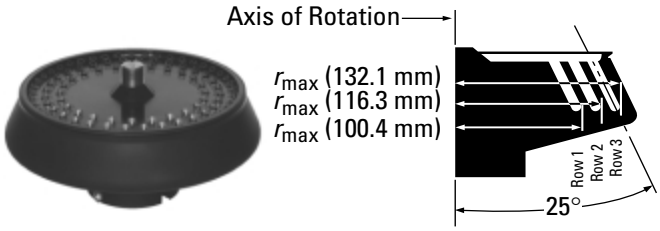
### Tubes

| Tube Style/Material | Part No. | Quantity | Volume (µL) | Size (mm) | Caps/ Spacers (qty. 1) | g-Force | k Factor | Maximum Speed |
|---|---|---|---|---|---|---|---|---|
| **Cellulose Propionate** | 342303 | 100 | 230 | 7 x 20 | ——— | 223,000 | 9 | 42,000 |
| **Thickwall Polyallomer** | 343621 | 100 | 230 | 7 x 20 | ——— | 223,000 | 9 | 42,000 |
| **Thickwall Polycarbonate** | 343775 | 100 | 230 | 7 x 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: **C D F G 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.)

**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:*

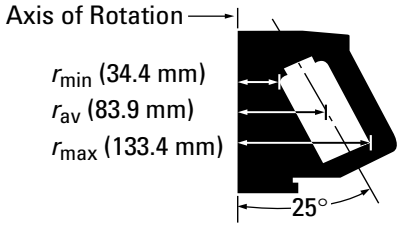
| | Row 1 | Row 2 | Row 3 |
|---|---|---|---|
| $r_{min}$ (mm) | 81.7 | 97.5 | 113.4 |
| force (g) | 57,200 | 68,300 | 79,400 |
| $r_{av}$ (mm) | 91.1 | 106.9 | 122.8 |
| force (g) | 63,800 | 74,800 | 86,000 |
| $r_{max}$ (mm) | 100.4 | 116.3 | 132.1 |
| force (g) | 70,300 | 81,400 | 92,500 |

## Rotor Replacement Parts

011757 O-ring for Rotor Handle
330333 Overspeed Disk, 25,000 rpm
335155 Mechanical Overspeed Device, 25,000 rpm
335453 Overspeed Disk, 23,000 rpm
335662 Mechanical Overspeed Device, 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<br>2⅜ x 4¾ in<br>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

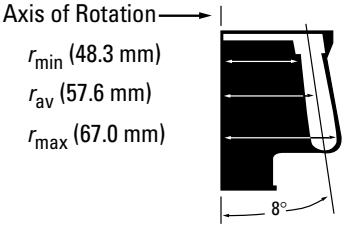
| Tube Style/Material | Part No. | Quantity | Vol. (mL) | Size (mm) | g-Force | k Factor | Maximum Speed |
|---|---|---|---|---|---|---|---|
| Polyallomer | 355627* | 6 | 250.0 | 60 x 121 | 53,900 | 951 | 19,000 |
| | 334205** | 1 | 250.0 | 60 x 121 | 53,900 | 951 | 19,000 |

### 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

** Bottle without Cap.*

*** Bottle with Cap Assembly.*




## 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 5.1mL<br>½ x 2 in<br>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 365891 Hex 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 section.)

### 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***

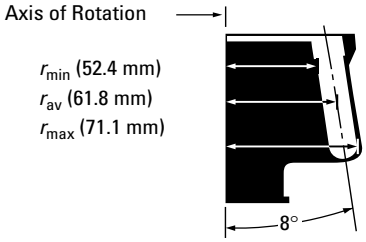
363304 Overspeed Disk, 100,000 rpm
368546 Rotor Replacement Plug (set of 8)
342882 Gasket for Rotor Plug
368544 Torx Adapter

† *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 CsC1 prescription, refer to rotor manual.

Major applications: Separation of plasmid or mitochondrial DNA in CsC1 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<br>½ x 2 in<br>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 356306 Hex 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 section.)

### 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
366306 Hex Plug-wrench Adapter

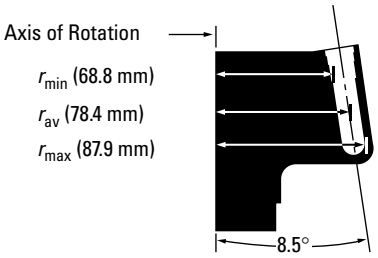
***For Rotors Manufactured After 1/2000***

355539 Overspeed Disk, 90,000 rpm
368548 Rotor Replacement Plug (set of 8)
342882 Gasket for Rotor Plug
368544 Torx Adapter

*† If replacing all rotor plugs, use Torx style, P/N 368548.*

### 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<br>½ x 2 in<br>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 356306 Hex 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 section.)

### 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 |
|---|---|---|---|---|---|---|---|---|---|
| **OOptiSeal 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
366306 Hex Plug-wrench Adapter

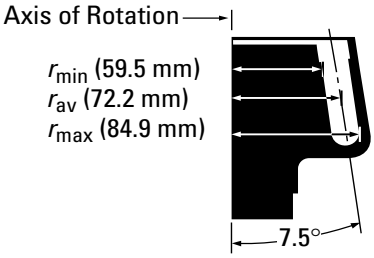
***For Rotors Manufactured After 1/2000***

330338 Overspeed Disk, 65,000 rpm
368548 Rotor Replacement Plug (set of 8)
342882 Gasket for Rotor Plug
368544 Torx Adapter

† *If replacing all rotor plugs, use Torx style, P/N 368548.*

### 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 CsC1 gradients.

| Max. RPM | Max. g | k Factor | Number of Tubes Volume/Size | Rotor Capacity |
|---|---|---|---|---|
| 65,000 | 402,000 | 21 | 8 x 13.5 mL<br>⅝ x 3 in<br>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 356306 Hex Plug-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 section.)

### 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 |
|---|---|---|---|---|---|---|---|---|---|
| **OOptiSeal 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 |
| | 357341* | 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.*

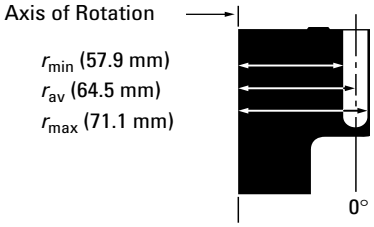
*Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.*

### Rotor Replacement Parts

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

### 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<br>½ x 2 in<br>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 356306 Hex 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 section.)

## 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 |
|---|---|---|---|---|---|---|---|---|---|
| **OOptiSeal 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
366306 Hex Plug-wrench Adapter

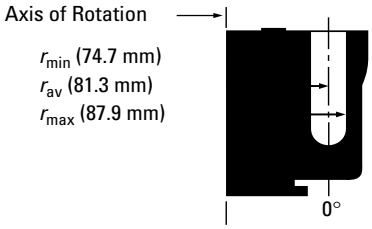
***For Rotors Manufactured After 1/2000***

355539 Overspeed Disk, 90,000 rpm
368548 Rotor Replacement Plug (set of 8)
342882 Gasket for Rotor Plug
368544 Torx Adapter

*† If replacing all rotor plugs, use Torx style, P/N 368548.*

## Adapters/Spacers

342883 345827 356866 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 | 416,000 | 10 | 16 x 5.1 mL<br>½ x 2 in<br>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 356306 Hex 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 section.)

### 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 |
|---|---|---|---|---|---|---|---|---|---|
| **OOptiSeal 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
366306 Hex Plug-wrench Adapter

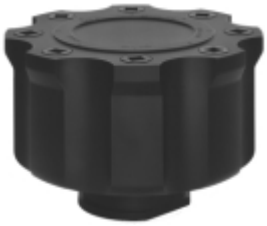
***For Rotors Manufactured After 1/2000***

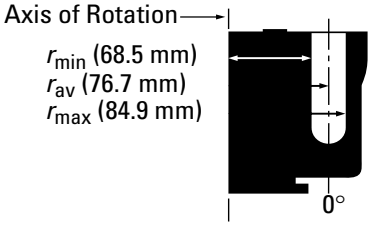
330338 Overspeed Disk, 65,000 rpm
368548 Rotor Replacement Plug (set of 8)
342882 Gasket for Rotor Plug
368544 Torx Adapter

† *If replacing all rotor plugs, use Torx style, P/N 368548.*

### 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<br>⅝ x 3 in<br>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 356306 Hex Plug-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 section.)

### 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 |
|---|---|---|---|---|---|---|---|---|---|
| **OOptiSeal 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 |
| | 357341* | 50 | ***10.0*** | 16 x 67 | ***349289*** | ***349901*** | 402,000 | 13 | 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 45 | ***349289*** | ***349900*** | 402,000 | 8 | 65,000 |
| | 357335* | 50 | ***6.3*** | 16 x 45 | ***349289*** | ***349900*** | 402,000 | 8 | 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
349291 Square-hole Plug-wrench Adapter

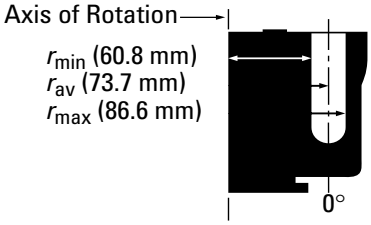
**For Rotors Manufactured After 8/87**

330338 Overspeed Disk, 65,000 rpm
355875 Rotor Plug, Hex Style**
349290 Gasket for Plug
356306 Hex Plug-wrench Adapter

***If replacing all Rotor Plugs, use Hex Style, P/N 355875.*

### 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 x 39 mL<br>1 x 3½ in<br>25 x 89 mm | 312 mL |

**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 section.)

### 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 |
|---|---|---|---|---|---|---|---|---|---|
| **OOptiSeal Polyallomer** | 362183 | 56 | 36.2 | 25 x 86 | 362204 | ——— | 242,000 | 36 | 50,000 |
| **Quick-Seal Polyallomer** | 342414 | 50 | 39.0 | 25 x 89 | 342417 | ——— | 242,000 | 36 | 50,000 |
| | 343665 | 50 | ***27.0*** | 25 x 64 | ***342417*** | ***343448*** | 242,000 | 36 | 50,000 |
| | 357347† | 50 | ***27.0*** | 25 x 64 | ***342417*** | ***343448*** | 242,000 | 36 | 50,000 |
| | 343664 | 50 | ***15.0*** | 25 x 38 | ***342417*** | ***343448**** | 242,000 | 36 | 50,000 |
| | 357344† | 50 | ***15.0*** | 25 x 38 | ***342417*** | ***343448*** | 242,000 | 36 | 50,000 |
| **Quick-Seal Ultra-Clear™** | 344326 | 50 | 39.0 | 25 x 89 | 342417 | ——— | 242,000 | 36 | 50,000 |
| | 344323 | 50 | ***27.0*** | 25 x 64 | ***342417*** | ***343448*** | 242,000 | 36 | 50,000 |
| | 344324 | 50 | ***15.0*** | 25 x 38 | ***342417*** | ***343448**** | 242,000 | 36 | 50,000 |

** Two required.*

*† 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**

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

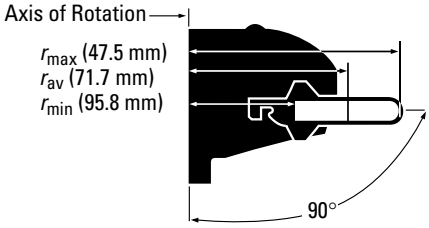
**For Rotors Manufactured After 8/87**

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

342417 343448 362204




## Swinging-Bucket Rotor, Titanium Head, and Buckets

For use in instruments classified: **G 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<br>7/16 x 2 3/8 in<br>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 841648 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.*

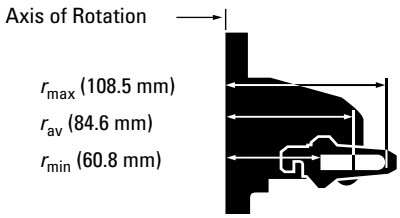
*Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.*

### Rotor Replacement Parts

331155 Overspeed Disk, 60,000 rpm
335459 Overspeed Disk, 54,000 rpm
331313 Bucket Holder Rack
332400 Rotor Stand
841648 O-ring for Bucket
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: **B C D F G H Q 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<br>½ x 2 in<br>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 |
| **Ultra-Clear** | 344057 | 50 | 5.0 | 13 x 51 | ——— | ——— | 368,000 | 48 | 55,000 |
| | 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.*

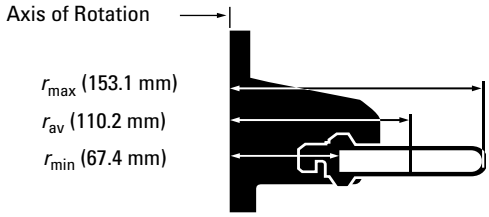
*Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.*

### 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: **C D F G 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<br>9/16 x 3½ in<br>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 |
| | 357331* | 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).*

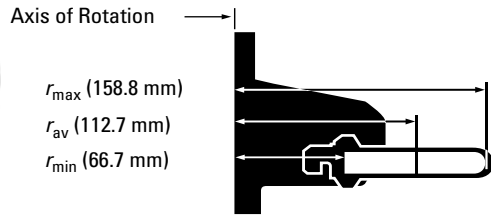
*Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.*

## 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: **G 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 x 14 mL<br>9/16 x 3¾ in<br>14 x 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 x 47 | ***355534*** | ——— | 285,000 | 61 | 40,000 |
| | 357331* | 50 | ***5.9*** | 14 x 47 | ***355534*** | ——— | 285,000 | 61 | 40,000 |
| | 355870 | 50 | ***3.5*** | 14 x 25 | ***355534*** | ——— | 285,000 | 35 | 40,000 |
| | 357330* | 50 | ***3.5*** | 14 x 25 | ***355534*** | ——— | 285,000 | 35 | 40,000 |
| **Quick-Seal *konical*™ Polyallomer** | 358650 | 50 | ***4.0*** | 14 x 48 | ***355534*** | ***358154*** | 280,000 | 57 | 40,000 |
| | 358649 | 50 | 8.0 | 14 x 89 | 355534 | 358154 | 280,000 | 130 | 40,000 |
| **Polyallomer** | 331374 | 50 | 14.0 | 14 x 95 | ——— | ——— | 285,000 | 137 | 40,000 |
| ***konical* Polyallomer** | 358120 | 50 | 10.0 | 14 x 89 | ———† | 358154 | 285,000 | 124 | 40,000 |
| **Ultra-Clear** | 344060 | 50 | 14.0 | 14 x 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).*

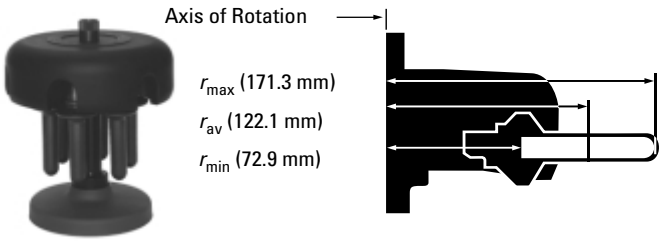
*Note: To help you locate g-Max tubes in the rotor listings, these tubes are highlighted with bold, italic type.*

## 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, Aluminum Head, and Titanium Buckets

For use in instruments classified: **C D F G H Q 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<br>⅝ x 4 in<br>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 |
| | 357342* | 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 |
| | 357338* | 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 |
| | 357336* | 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 |
| | 357333* | 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* Polyallomer** | 358123 | 50 | 14.5 | 16 x 102 | ——— | 358155 | 148,000 | 276 | 28,000 |
| | 358122 | 50 | ***5.5*** | 16 x 51 | ——— | 358155 | 148,000 | 114 | 28,000 |
| **Ultra-Clear** | 344061 | 50 | 17.0 | 16 x 102 | ——— | ——— | 150,000 | 276 | 28,000 |

** 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

330333 Overspeed Disk, 25,000 rpm
331186 Bucket Holder Rack
332400 Rotor Stand
335155 Mechanical Overspeed Device, 25,000 rpm (M version only)
342210 Mechanical Overspeed Device, 28,000 rpm (M version only)
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

The buckets of the SW 30 and SW 30.1 also can be used with the SW 28.1 Rotor head.

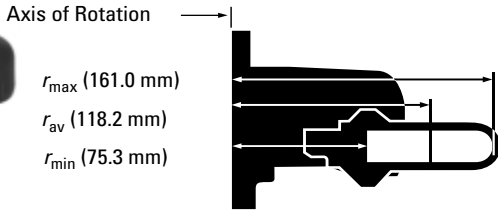
346385 SW 30 Rotor Bucket Assembly, Titanium, with Caps and O-rings, matched set of 6
346386 SW 30.1 Rotor Bucket Assembly, Titanium, with Caps and O-rings, matched set of 6

*Note: A special rotor is required for the L2-50, L2-65, L3-40, and L3-50. If you are running one of these instruments, choose one of the following:*

**No. 358106.** SW 28.1M Rotor Assembly
**No. 357540.** SW 28.1M Rotor Assembly with spare parts/supplies

### Adapters/Spacers

355579 358155




## Swinging-Bucket Rotor, Aluminum Head, and Titanium Buckets

For use in instruments classified: **C D F G H Q 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<br>1 x 3½ in<br>25 x 89 mm | 234 mL |

**Rotor Package: No. 342204.** SW 28 Rotor with 2 boxes 326823 Polyallomer Tubes, 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 | ***33.0*** | 25 x 83 | ***355536*** | ——— | 141,000 | 234 | 28,000 |
| **Polyallomer** | 357350* | 50 | ***33.0*** | 25 x 83 | ***355536*** | ——— | 141,000 | 234 | 28,000 |
| | 343665 | 50 | ***27.0*** | 25 x 64 | ***355536*** | ——— | 141,000 | 164 | 28,000 |
| | 357348* | 50 | ***27.0*** | 25 x 64 | ***355536*** | ——— | 141,000 | 164 | 28,000 |
| | 343664 | 50 | ***15.0*** | 25 x 38 | ***355536*** | ——— | 141,000 | 87 | 28,000 |
| | 357345* | 50 | ***15.0*** | 25 x 38 | ***355536*** | ——— | 141,000 | 87 | 28,000 |
| **Quick-Seal** | 358651 | 50 | 28.0 | 25 x 83 | 355536 | 358156 | 139,000 | 234 | 28,000 |
| **Polyallomer** | 358654 | 50 | 23.0 | 25 x 76 | 355536 | 358156 | 139,000 | 206 | 28,000 |
| ***konical*™** | 358652 | 50 | ***8.5*** | 25 x 38 | ***355536*** | ***358156*** | 139,000 | 87 | 28,000 |
| ***konical*** | 358126 | 50 | 30.0 | 25 x 89 | ——— | 358156 | 139,000 | 246 | 28,000 |
| **Polyallomer** | 358125 | 50 | 25.0 | 25 x 76 | ——— | 358156 | 139,000 | 206 | 28,000 |
| **Thickwall Polyallomer** | 355642 | 25 | 32.0 | 25 x 89 | ——— | ——— | 141,000 | 246 | 28,000 |
| **Thickwall Polycarbonate** | 355631 | 25 | 32.0 | 25 x 89 | ——— | ——— | 141,000 | 246 | 28,000 |
| **Polyallomer** | 326823 | 50 | 38.5 | 25 x 89 | ——— | ——— | 141,000 | 246 | 28,000 |
| **Ultra-Clear** | 344058 | 50 | 38.5 | 25 x 89 | ——— | ——— | 141,000 | 246 | 28,000 |

** 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

330333 Overspeed Disk, 25,000 rpm
331186 Bucket Holder Rack
332400 Rotor Stand
335155 Mechanical Overspeed Device, 25,000 rpm (M version only)
342210 Mechanical Overspeed Device, 28,000 rpm (M version only)
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

The buckets of the SW 30 and SW 30.1 also can be used with the SW 28 Rotor head.

346385 SW 30 Rotor Bucket Assembly, Titanium, with Caps and O-rings, matched set of 6
346386 SW 30.1 Rotor Bucket Assembly, Titanium, with Caps and O-rings, matched set of 6

*Note: A special rotor is required for the L2-50, L2-65, L3-40, and L3-50. If you are running one of these instruments, choose one of the following:*

**No. 358105.** *SW 28M Rotor Assembly*
**No. 357539.** *SW 28M Rotor Assembly with spare parts/supplies*

### Adapters/Spacers

355536 358156

## Tubes, Caps & Replacement Parts for Discontinued Rotors



### Type 15 Fixed-Angle Rotor
### DISCONTINUED 1980

***No Replacement***
For use in instruments classified: C D F

**No tubes are available. Tubes are obsolete.**

**Replacement Parts:**

| | |
|---|---|
| 815472 | O-ring for Rotor Handle |
| 858896 | O-ring for Canister Cap |

### 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 |

### Type 28 Fixed-Angle Rotor (cont'd)

**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 30 Fixed-Angle Rotor
### DISCONTINUED 1992

***Recommended Replacement: Type 50.2 Ti***
For use in instruments classified: H R S

| Tubes | P/N | Vol. | Size | Caps/ Spacer |
|---|---|---|---|---|
| Ultra-Clear™ | 344058 | 38.5 | 25 x 89 | 331151 |
| Quick-Seal® Ultra-Clear | 344326 | 39.0 | 25 x 89 | ***342699*** |
| Polyallomer | 344367 | 35.0 | 25 x 83 | 337927 |
| Thickwall Polyallomer | 355642 | 30.0 | 25 x 89 | |
| Quick-Seal Polyallomer | 342414 | 39.0 | 25 x 89 | ***342699*** |
| | 326823 | 38.5 | 25 x 89 | 302359 |
| Thickwall Polycarbonate | 355631 | 30.0 | 25 x 89 | |
| Polycarbonate Bottle | 355616 | 26.3 | 25 x 89 | |

**Replacement Parts:**

| | |
|---|---|
| 011757 | O-ring for Rotor Handle |
| 330334 | Overspeed Disk, 30,000 rpm |
| 331193 | Overspeed Disk, 27,000 rpm |
| 334967 | Rotor Handle |
| 801769 | O-ring for Rotor Lid |
| 302671 | Lid, Rotor |

### Type 30.2 Fixed-Angle Rotor
### DISCONTINUED 1981

***No Replacement***
For use in instruments classified: H R

| Tubes | P/N | Vol. | Size |
|---|---|---|---|
| Thickwall Polyallomer | 355639 | 5.5 | 13 x 89 |
| Thickwall Polycarbonate | 355629 | 5.5 | 13 x 89 |

**Replacement Parts:**

| | |
|---|---|
| 011757 | O-ring for Rotor Handle |
| 330334 | Overspeed Disk, 30,000 rpm |
| 331193 | Overspeed Disk, 27,000 rpm |
| 801769 | O-ring for Rotor Lid |
| 303091 | Lid, Rotor |

## Tubes, Caps & Replacement Parts for Discontinued Rotors

### Type 35 Fixed-Angle Rotor DISCONTINUED 1994

***Recommended Replacement: Type 45 Ti***
For use in instruments classified: H R S

| Tubes | P/N | Vol. | Size | Caps/ Spacer |
|---|---|---|---|---|
| Ultra-Clear | 345777 | 94.0 | 38 x 102 | 330901 |
| Quick-Seal Ultra-Clear | 345778 | 94.0 | 38 x 102 | ***342697*** |
| Polyallomer | 345775 | 94.0 | 38 x 102 | 330901 |
| Thickwall Polyallomer | 355643 | 81.0 | 38 x 102 | |
| Quick-Seal Polyallomer | 345776 | 94.0 | 38 x 102 | ***342697*** |
| Thickwall Polycarbonate | 355628 | 81.0 | 38 x 102 | |
| Polycarbonate Bottle | 355622 | 70.0 | 38 x 102 | |

**Replacement Parts:**

| | |
|---|---|
| 011757 | O-ring Rotor Handle |
| 334969 | Rotor Handle |
| 332620 | Overspeed Disk, 35,000 rpm |
| 335455 | Overspeed Disk, 31,000 rpm |
| 801767 | O-ring for 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 |
| 335154 | Mechanical Overspeed Device, 40,000 rpm |
| 330335 | Overspeed Disk, 40,000 rpm |
| 333761 | Overspeed Disk, 36,000 rpm |
| 336461 | Mechanical Overspeed Device, 45,000 rpm |
| 334967 | Rotor Handle |
| 807474 | O-ring for Rotor Lid |
| 302602 | Lid, Rotor |

### 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 40.2 Fixed-Angle Rotor (cont'd)

**Replacement Parts:**

| | |
|---|---|
| 011757 | O-ring for Rotor Handle |
| 330335 | Overspeed Disk, 40,000 rpm |
| 333761 | Overspeed Disk, 36,000 rpm |
| 335154 | Overspeed Device, 40,000 rpm |
| 336461 | Overspeed Device, 36,000 rpm |
| 801762 | O-ring for rotor lid |
| 303194 | Lid, Rotor |

### Type 40.3 Fixed-Angle Rotor DISCONTINUED 1985

***Recommended Replacement: Type 50.4 Ti***
For use in instruments classified: A B C D F G H Q R

| 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 | |

**Replacement Parts:**

| | |
|---|---|
| 011757 | O-ring for Rotor Handle |
| 330335 | Overspeed Disk, 40,000 rpm |
| 333761 | Overspeed Disk, 36,000 rpm |
| 335154 | Overspeed Device, 40,000 rpm |
| 336461 | Overspeed Device, 36,000 rpm |
| 801767 | O-ring for Rotor Lid |

### Type 42.1 Fixed-Angle Rotor DISCONTINUED 1993

***Recommended Replacement: Type 55.2 Ti, Type 50.2 Ti***
For use instruments classified: H R S

| Tubes | P/N | Vol. | Size | Caps/ Spacer |
|---|---|---|---|---|
| Ultra-Clear | 344058 | 38.5 | 25 x 89 | 331151 |
| Quick-Seal Ultra-Clear | 344326 | 39.0 | 25 x 89 | ***342699*** |
| Polyallomer | 344367 | 35.0 | 25 x 83 | 337927 |
| Thickwall Polyallomer | 355642 | 30.0 | 25 x 89 | |
| Quick-Seal Polyallomer | 342414 | 39.0 | 25 x 89 | ***342699*** |
| Thickwall Polycarbonate | 355631 | 30.0 | 25 x 89 | |
| Polycarbonate Bottle | 355618 | 26.3 | 25 x 89 | |

**Replacement Parts:**

| | |
|---|---|
| 011757 | O-ring for Rotor Handle |
| 330329 | Overspeed Disk, 40,000 rpm |
| 335457 | Overspeed Disk, 38,000 rpm |
| 334970 | Rotor Handle |
| 858125 | O-ring for Rotor Lid |
| 331162 | Rotor Lid |

## Tubes, Caps & Replacement Parts for Discontinued Rotors

### 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 |
| 335158 | Mechanical Overspeed Device, 50,000 rpm |
| 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 |
| 316014 | Rotor Lid |

### 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 |
| 334968 | Rotor Handle |
| 335158 | Mechanical Overspeed Device, 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 |

### Type 50.3 Ti Fixed-Angle Rotor (cont'd)

**Replacement Parts:**

| | |
|---|---|
| 011757 | O-ring for Rotor Handle |
| 330336 | Overspeed Disk, 50,000 rpm |
| 343146 | Rotor Handle |
| 335158 | Mechanical Overspeed Device, 50,000 rpm |
| 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 |
| 334971 | Rotor Handle |
| 331115 | Overspeed Disk, 60,000 rpm |
| 858125 | O-ring for Rotor Lid |
| 331149 | Rotor Lid |

## Tubes, Caps & Replacement Parts for Discontinued Rotors



### 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) |
| 330209 | Rotor Lid |
| 334972 | Rotor Handle |

### Type 75 Ti Fixed-Angle Rotor
### DISCONTINUED 1991

***Recommended Replacement: Type 80 Ti, Type 90 Ti***
For use in instruments classified: F G H R S

| Tubes | P/N | Vol. | Size | Caps/ Spacer |
|---|---|---|---|---|
| Ultra-Clear™ | 344085 | 13.5 | 16 x 76 | 341968 |
| Quick-Seal® Ultra-Clear | 344322 | 13.5 | 16 x 76 | ***342695*** |
| Polyallomer | 326814 | 13.5 | 16 x 76 | 341968 |
| Thickwall Polyallomer | 355640 | 10.0 | 16 x 76 | |
| Quick-Seal Polyallomer | 342413 | 13.5 | 16 x 76 | ***342695*** |
| Thickwall Polycarbonate | 355630 | 10.0 | 16 x 76 | |
| Polycarbonate Bottle | 355603 | 10.4 | 16 x 76 | |

**Replacement Parts:**

| | |
|---|---|
| 010018 | O-ring for Rotor Handle |
| 334217 | Overspeed Disk, 75,000 rpm |
| 335585 | Overspeed Disk, 70,000 rpm |
| 335377 | Rotor Handle |
| 854524 | O-ring for Rotor Lid |
| 334214 | Lid, Rotor |

### 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 |

### SW 25.1 Swinging-Bucket Rotor
### DISCONTINUED 1993

***Recommended Replacement: SW 28.1***
For use in instruments classified: A B C D F G H Q R S

| Tubes | P/N | Vol. | Size |
|---|---|---|---|
| Ultra-Clear | 344063 | 34.0 | 25 x 76 |
| Polyallomer | 326825 | 34.0 | 25 x 76 |
| Thickwall Polyallomer | 355638 | 27.0 | 25 x 76 |
| Thickwall Polycarbonate | 355637 | 27.0 | 25 x 76 |

**Replacement Parts:**

| | |
|---|---|
| 324413 | Bucket Set with Caps, set of 3 |
| 303434 | Gasket for Bucket |
| 303436 | Hinge Pin Bearing |
| 324616 | Hinge Pin, One pressed on |
| 332400 | Rotor Stand |
| 330333 | Overspeed Disk, 25,000 rpm |
| 335453 | Overspeed Disk, 23,000 rpm |
| 335155 | Overspeed Device, 25,000 rpm |
| 335662 | Overspeed Device, 23,000 rpm |

### SW 25.2 Swinging-Bucket Rotor
### DISCONTINUED 1980

***Recommended Replacement: SW 28***
For use in instruments classified: C D F G H R

| Tubes | P/N | Vol. | Size |
|---|---|---|---|
| Ultra-Clear | 344058 | 60.0 | 32 x 89 |
| Polyallomer | 326951 | 60.0 | 32 x 89 |

**Replacement Parts:**

| | |
|---|---|
| 326153 | Bucket Set with Caps, Set of 6 |
| 303436 | Hinge Pin Bearing |
| 324616 | Hinge Pin with one Bearing on |
| 325607 | Gasket for Bucket |
| 331760 | Caps, Set of 3 |
| 332400 | Rotor Stand |
| 330333 | Overspeed Disk, 25,000 rpm |
| 335453 | Overspeed Disk, 23,000 rpm |
| 335155 | Overspeed Device, 25,000 rpm |
| 335662 | Overspeed Device, 23,000 rpm |

### SW 27 Swinging-Bucket Rotor
### DISCONTINUED 1979

***Recommended Replacement: SW 28***
For use in instruments classified: C D F G H R

| Tubes | P/N | Vol. | Size | Caps/ Spacer |
|---|---|---|---|---|
| Ultra-Clear | 344058 | 38.5 | 25 x 89 | |
| Polyallomer | 326823 | 38.5 | 25 x 89 | |
| Thickwall Polyallomer | 355642 | 32.0 | 25 x 89 | |
| Quick-Seal Polyallomer | 344623 | 33.0 | 25 x 83 | 355536 |
| Thickwall Polycarbonate | 355631 | 32.0 | 25 x 89 | |

**Replacement Parts:**

| | |
|---|---|
| 331186 | Bucket Holder Rack |
| 331183 | Bucket Cap (each) |
| 332400 | Rotor Stand |
| 331193 | Overspeed Disk, 27,000 rpm |
| 335454 | Overspeed Disk, 24,000 rpm |
| 335161 | Overspeed Device, 27,000 rpm |
| 335661 | Overspeed Device, 24,000 rpm |
| 340090 | Bucket Set with Caps, set of 6 |
| 812715 | O-ring for Buckets |

## Tubes, Caps & Replacement Parts for Discontinued Rotors

### SW 27.1 Swinging-Bucket Rotor
### DISCONTINUED 1979

***Recommended Replacement: SW 28.1***
For use in instruments classified: C D F G H R

| Tubes | P/N | Vol. | Size | Caps/ Spacer |
|---|---|---|---|---|
| Ultra-Clear | 344061 | 17.0 | 16 x 102 | |
| Polyallomer | 337986 | 17.0 | 16 x 102 | |
| Quick-Seal Polyallomer | 356291 | 18.0 | 16 x 102 | 355579 |

**Replacement Parts:**

| | |
|---|---|
| 331186 | Bucket Holder Rack |
| 332400 | Rotor Stand |
| 331193 | Overspeed Disk, 27,000 rpm |
| 335454 | Overspeed Disk, 24,000 rpm |
| 335161 | Overspeed Device, 27,000 rpm |
| 335661 | Overspeed Device, 24,000 rpm |
| 340086 | Bucket set with Caps, set of 6 |
| 815472 | O-ring for Buckets |

### 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 *k*onical™ 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 Asembly, 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 | |
| *k*onical™ 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 Swinging-Bucket Rotor
### DISCONTINUED 1972

***Recommended Replacement: SW 55 Ti***
For use in instruments classified: A B C D F G H Q R

| Tubes | P/N | Vol. | Size | Caps/ Spacer |
|---|---|---|---|---|
| Ultra-Clear | 344057 | 5.0 | 13 x 51 | |
| Polyallomer | 326819 | 5.0 | 13 x 51 | |
| Thickwall Polyallomer | 349623 | 3.5 | 13 x 51 | |
| Quick-Seal Polyallomer | 345829 | 2.0 | 13 x 25 | 355535 |
| Thickwall Polycarbonate | 349622 | 3.5 | 13 x 51 | |

**Replacement Parts:**

| | |
|---|---|
| 301560 | Gasket for Bucket |
| 327831 | Hinge Pin & Bearing Assy |
| 328239 | Bucket Holder Rack |
| 330336 | Overspeed Disk, 50,000 rpm |
| 335458 | Overspeed Disk, 45,000 rpm |
| 335158 | Overspeed Device, 50,000 rpm |
| 335657 | Overspeed Device, 45,000 rpm |

### 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 *k*onical™ Polyallomer | 358647 | 3.2 | 13 x 51 | 355535 |
| Thinwall Polyallomer | 326819 | 5.0 | 13 x 51 | |
| *k*onical 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 |

### SW 56 Swinging-Bucket Rotor
### DISCONTINUED 1974

***Recommended Replacement: SW 60***
For use in instruments classified: B C D F G H Q R

| Tubes | P/N | Vol. | Size | Caps/ Spacer |
|---|---|---|---|---|
| Ultra-Clear™ | 344062 | 4.0 | 11 x 60 | |
| Polyallomer | 328874 | 4.0 | 11 x 60 | |
| Thickwall Polyallomer | 355636 | 3.0 | 11 x 60 | |
| Quick-Seal® Polyallomer | 344624 | 1.5 | 11 x 25 | 344674 |
| Thickwall Polycarbonate | 355635 | 3.0 | 11 x 60 | |

**Replacement Parts:**

| | |
|---|---|
| 332400 | Rotor Stand |
| 328896 | Overspeed Disk, 56,000 rpm |
| 330336 | Overspeed Disk, 50,000 rpm |
| 331313 | Bucket Holder Rack |
| 301560 | Gasket |
| 328908 | Caps, Set of 6 |

## Tubes, Caps & Replacement Parts for Discontinued Rotors



### SW 65 Ti Swinging-Bucket Rotor
### DISCONTINUED 1994

***Recommended Replacement: SW 60***

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

| Tubes | P/N | Vol. | Size | Caps/ Spacer |
|---|---|---|---|---|
| Ultra-Clear | 344057 | 5.0 | 13 x 51 | |
| Polyallomer | 326819 | 5.0 | 13 x 51 | |
| Thickwall Polyallomer | 349623 | 3.5 | 13 x 51 | |
| Quick-Seal Polyallomer | 345829 | 2.0 | 13 x 25 | 355535 |
| Thickwall Polycarbonate | 349622 | 3.5 | 13 x 25 | |

**Replacement Parts:**

330338 Overspeed Disk, 65,000 rpm
331155 Overspeed Disk, 60,000 rpm
332400 Rotor Stand
331767 Bucket Set with Caps, Set of 3
301560 Gasket for Bucket
327831 Hinge Pin, One pressed on
330226 Hinge Pin Bearing
331762 Caps, Matched set of 3

### VTI 80 Rotor
### DISCONTINUED 1990

***Recommended Replacement: VTi 90***

For use in instruments classified: H R S

| Tubes | P/N | Vol. | Size | Caps/ Spacer |
|---|---|---|---|---|
| OptiSeal Polyallomer | 362185 | 4.9 | 13 x 51 | ***362198*** |
| Quick-Seal Polyallomer | 342412 | 5.1 | 13 x 51 | ***342883*** |
| Quick-Seal Ultra-Clear | 344075 | 5.1 | 13 x 51 | ***342883*** |

**Replacement Parts:**

*(see VTi 90 for latest plugs)*
342881 Rotor Plug
342882 Plug Gasket
341965 Overspeed Disk, 80,000 rpm
342705 Rotor Vise Assembly
356306 Hex-plug Adapter
858121 Torque Wrench

### VTI 65 Rotor
### DISCONTINUED 1994

***Recommended Replacement: VTi 65.2, VTi 90***

For use in instruments classified: H R S

| Tubes | P/N | Vol. | Size | Caps/ Spacer |
|---|---|---|---|---|
| Quick-Seal Polyallomer | 342412 | 5.1 | 13 x 51 | 342418 |
| Quick-Seal Ultra-Clear | 344075 | 5.1 | 13 x 51 | 342418 |

**Replacement Parts for Rotors Manufactured Prior to 8/87:**

340673 Obsolete. Use 355874
*Caution: when ordering 355874 as a replacement for 340673, you* ***must*** *order an even number (2, 4, 6, 8, etc.) and use them in positions on the rotor directly opposite each other. It is highly recommended that you order a full replacement set (8 each) and dispose of older two-hole style plugs. This will eliminate the possibility of rotor imbalance that could result from improper placement of the mixed-hex (355874) and two-hole (340673) style plugs. Required adapter for hex-style plug is 356306, hex plug-wrench adapter.*
340674 Plug Gasket
330338 Overspeed Disk, 65,000 rpm
345795 Two Hole Plug-wrench Adapter
858121 Torque Wrench

### VTI 65 Rotor (cont'd)

**Replacement Parts for Rotors Manufactured After 8/87:**

355874 Rotor Plug, Hex Style
340674 Plug Gasket
330338 Overspeed Disk, 65,000 rpm
356306 Hex Plug-wrench Adapter
858121 Torque Wrench

### VC 53 Rotor
### DISCONTINUED 1994

***Recommended Replacement: VTi 50***

For use in instruments classified: H R S

| Tubes | P/N | Vol. | Size | Caps/ Spacer |
|---|---|---|---|---|
| OptiSeal Polyallomer | 362183 | 36.2 | 25 x 86 | ***362204*** |
| Quick-Seal Polyallomer | 342414 | 39.0 | 25 x 89 | ***342417*** |
| Quick-Seal Ultra-Clear | 344326 | 39.0 | 25 x 89 | ***342417*** |

**Replacement Parts:**

355587 Rotor Plug
340825 Plug Gasket
328896 Overspeed Disk, 55,000 rpm
332688 Rotor Vise Assembly
355588 Hex-plug Adapter
889096 Torque Wrench

### VAC 50 Rotor
### DISCONTINUED 1994

***Recommended Replacement: VTi 50***

For use in instruments classified: H R S

| Tubes | P/N | Vol. | Size | Caps/ Spacer |
|---|---|---|---|---|
| OptiSeal Polyallomer | 362183 | 36.2 | 25 x 86 | ***362204*** |
| Quick-Seal Polyallomer | 342414 | 39.0 | 25 x 89 | ***342417*** |
| Quick-Seal Ultra-Clear | 344326 | 39.0 | 25 x 89 | ***342417*** |

**Replacement Parts:**

355587 Rotor Plug
340825 Plug Gasket
330336 Overspeed Disk, 50,000 rpm
332688 Rotor Vise Assembly
355588 Hex-plug Adapter
889096 Torque Wrench

## Tubes, Caps & Replacement Parts for Discontinued Rotors



**Zonal Rotor, Titanium**
**DISCONTINUED 1997**

***Recommended Replacement: Z-60, 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 |
| 336828 | Cap Assembly |
| | 336831 Snap Ring for Cap Assembly |
| | 829659 O-ring for Cap Assembly |
| | (also used at bottom of Bushing in |
| | 336562 Coupling.) |
| 824528 | O-ring, top of Bushing in |
| | 336562 Coupling |
| 829659 | O-ring, bottom of Bushing in |
| | 336562 Coupling (also used in |
| | 336828 Cap Assembly.) |
| 834499 | O-ring, bottom of Transfer Shaft |
| 854540 | O-ring, middle of Bushing in |
| | 336562 Coupling |
| 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 |

## Continuous Flow Rotor, Titanium

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

Major applications: Isopycnic banding of viruses.

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

*See also page 1-2 for factory installation.*

### CF-32 Ti Rotor Kit

**350700** Basic Rotor Kit. Use with L5, L8, or Optima™

**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.

**354097** CF-32 Rotor Package for L8, 220 V, 50 Hz
**357557** CF-32 Rotor Package for L8, 120 V, 60 Hz
**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
**354695** Door Kit and Hardware for L8/L8M
**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 back pressure of 20 psi (138 kPa) also is required. We recommend the Cole Parmer Complete Pump (#P-77961-00) which includes Pump (#07549), Pump Head (#07529), and Pump Tubing (#06429). Assembly can be purchased directly from the manufacturer:

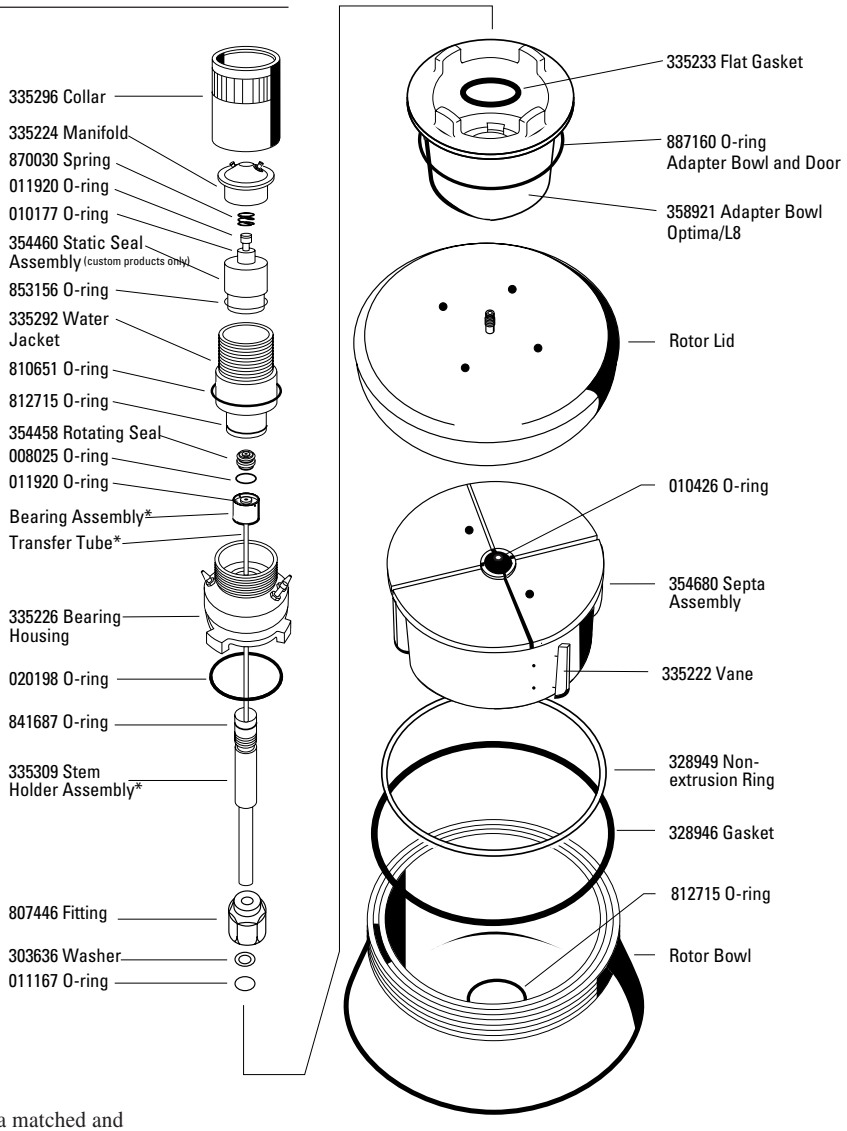
Barnant Corporation
P.O. Box 510
Barrington, IL 60010
Internet address: http://www.barnant.com

### 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 |
| 885203 | 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: 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: **B C D F G H Q 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. 328913.** Type Ti-15 Titanium Zonal Rotor and Lid, 332676 Push-pull Cap, 333857 Noryl Core. 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 back pressure of 20 psi (138 kPa) also is required. We recommend the Cole Parmer Complete Pump (#P-77961-00) which includes Pump (#07549), Pump Head (#07529), and Pump Tubing (#06429). Assembly can be purchased directly from the manufacturer:

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

### 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 |
| 335452 | Al-15 Overspeed Disk, 20,000 rpm |
| 332621 | Al-15 Overspeed Disk, 22,000 rpm |
| 335456 | Ti-15 Overspeed Disk, 32,000 rpm |
| 336821 | Ti-15 Overspeed Disk, 29,000 rpm |
| 335164 | Al-15 Mechanical Overspeed Device, 22,000 rpm |
| 335663 | Al-15 Mechanical Overspeed Device, 20,000 rpm |
| 335659 | Ti-15 Mechanical Overspeed Device, 32,000 rpm |
| 336834 | Ti-15 Mechanical Overspeed Device, 29,000 rpm |

### Tool Kits/Additional Parts

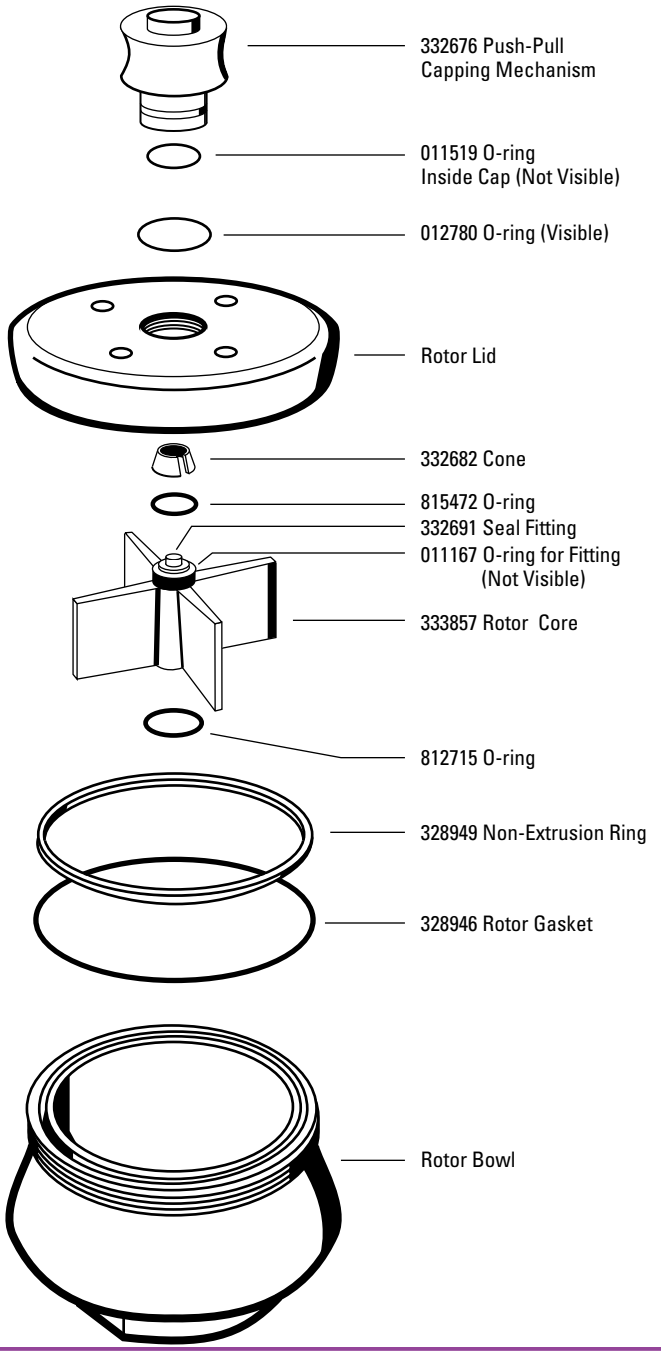
| | | | |
|---|---|---|---|
| 328917 | Rotor Tool Kit | 354192 | Standoff (qty. 3 req'd for field installations) |
| 332688 | Rotor Vise | | |
| 332690 | Spanner Wrench | 961778 | Vibe Mount (qty. 3 req'd for field installations) |
| 333763 | Tubing Removal Tool | | |
| 858532 | Pliers | | |

### 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 toTitanium 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: **B C D F G H Q 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, 332676 Push-Pull Cap, 333856 Noryl Core, 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 back pressure of 20 psi (138 kPa) also is required. We recommend the Cole Parmer Complete Pump (#P-77961-00) which includes Pump (#07549), Pump Head (#07529), and Pump Tubing (#06429). Assembly can be purchased directly from the manufacturer:

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

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

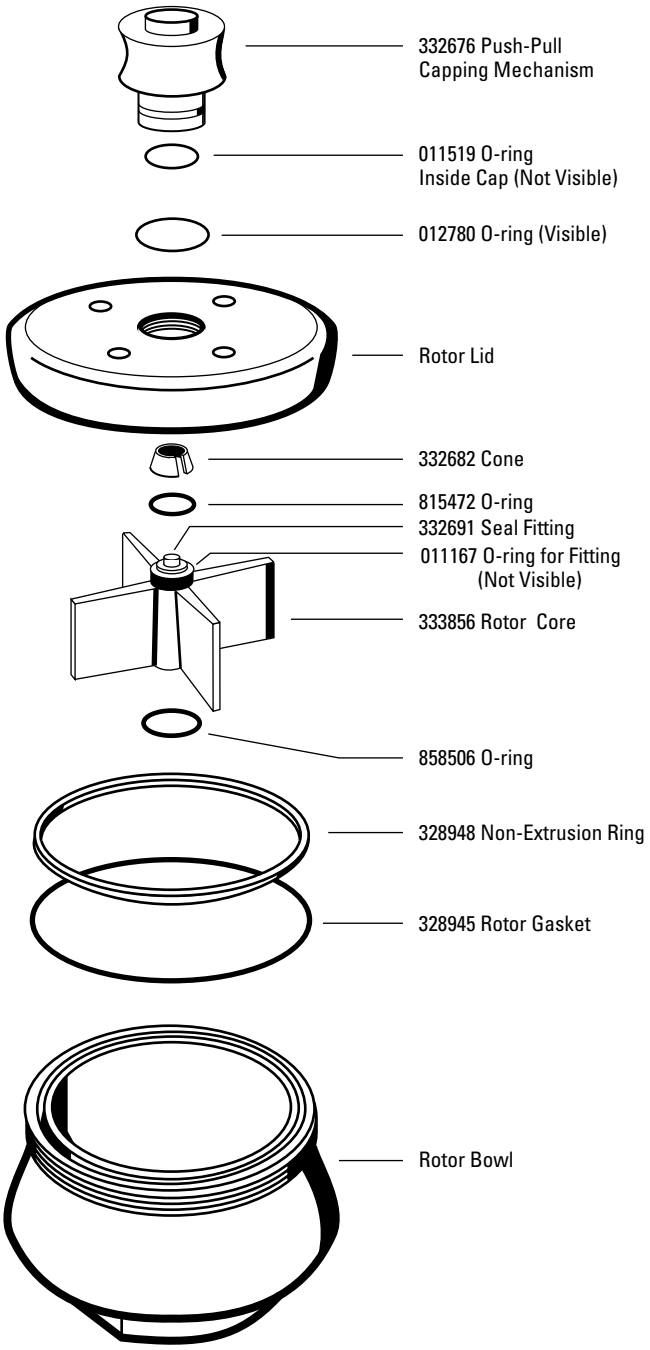
| | |
|---|---|
| 328945 | Rotor Gasket |
| 328948 | Non-extrusion Ring |
| 332676 | Push-Pull Cap |
| 332682 | Cone |
| 333856 | Rotor Core, Noryl |
| | 815472 O-ring, top of Rotor Core |
| | 011167 O-ring for Seal Fitting |
| | 858506 O-ring, bottom of Rotor Core |
| | 332691 Seal Fitting |
| | 011519 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 |
| 335455 | Al-14 Overspeed Disk, 31,000 rpm |
| 335160 | Ti-14 Mechanical Overspeed Device, 42,000 rpm |
| 335162 | Ti-14 Mechanical Overspeed Device, 48,000 rpm |
| 335163 | Al-14 Mechanical Overspeed Device, 35,000 rpm |
| 335660 | Al-14 Mechanical Overspeed Device, 31,000 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 wtih the B-29 Type Core.



**For Zonal Rotors**

For use in instruments classified: **A B C D F G H N O P Q 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, L5-B,L5, L3-40/50, Optima™ XL

Optimas with Ti 15 rotors require each of the following parts:
337890 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

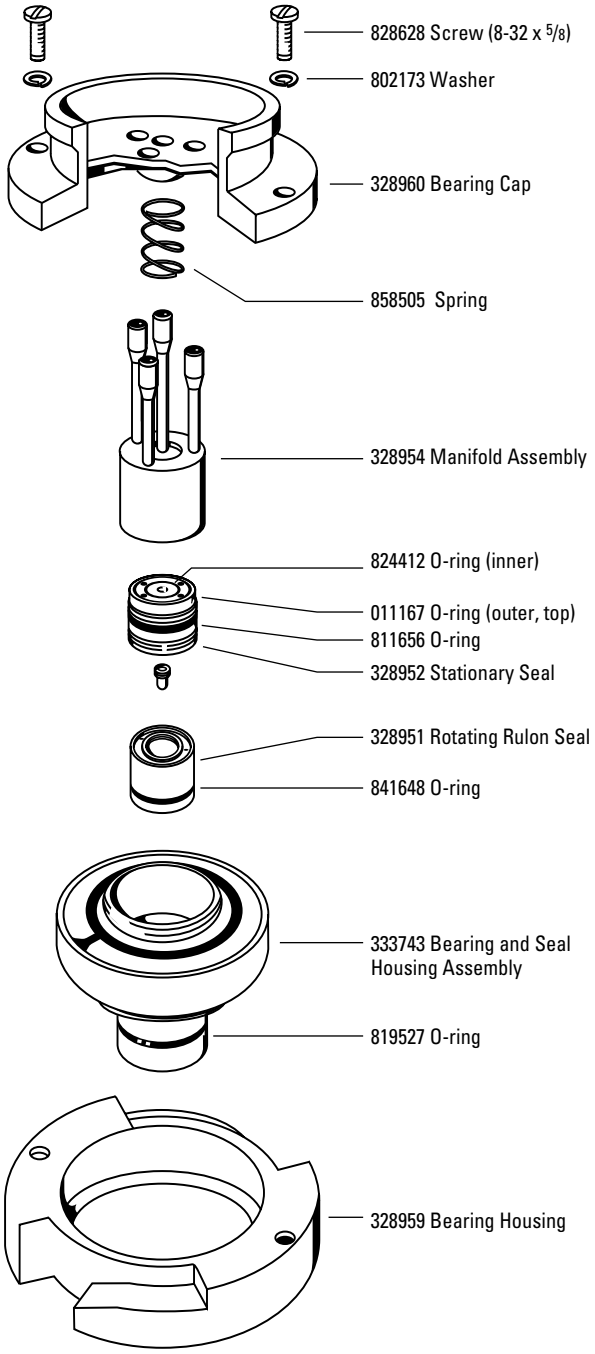
The Mounting Hardware will be installed by a Beckman Coulter Service Representative at no extra cost. In addition to the Gradient Pump, the following installation necessities not supplied by Beckman Coulter are needed: a syringe (50 or 100 mL) for introducing sample, and two hemostats or other clamping 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 |
| 841648 | O-ring, for Rotating Seal |
| 858505 | Spring, for Seal Assembly |
| 328954 | Manifold |

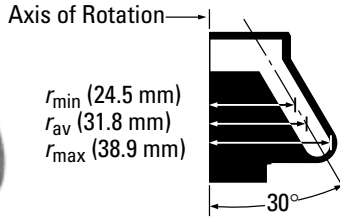
## Tool Kits

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



## Quick-Reference Guide to Rotor Specifications and Tabletop UltracentrifugeCompatibility

| 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 Tabletop, Optima MAX, Optima MAX-E |
| **TLA-120.1** | 120,000 | 627,000 | 8 | 14 x 0.5 | 7 | TL-100, Optima™ TL, Optima TLX Tabletop, Optima MAX, Optima MAX-E |
| **TLA-110** | 110,000 | 657,000 | 13 | 8 x 5.1 | 40.8 | TL-100, Optima™ TL, Optima TLX Tabletop, Optima MAX, Optima MAX-E |
| **TLA-100.3** | 100,000 | 541,000 | 14 | 6 x 3.5 | 21 | TL-100, Optima™ TL, Optima TLX Tabletop, Optima MAX, Optima MAX-E |
| **TLA-100** | 100,000 | 436,000 | 7 | 20 x 0.2 | 4 | TL-100, Optima™ TL, Optima TLX Tabletop, Optima MAX, Optima MAX-E |
| **TLA-55** | 55,000 | 186,000 | 66 | 12 x 1.5 | 18 | TL-100, Optima™ TL, Optima TLX Tabletop, Optima MAX, Optima MAX-E |
| **TLS-55** | 55,000 | 259,000 | 50 | 4 x 2.2 | 8.8 | TL-100, Optima™ TL, Optima TLX Tabletop, Optima MAX, Optima MAX-E |
| **TLN-120** | 120,000 | 585,000 | 7 | 8 x 1.2 | 9.6 | TL-100, Optima™ TL, Optima TLX Tabletop, Optima MAX, Optima MAX-E |
| **TLN-100** | 100,000 | 450,000 | 14 | 8 x 3.9 | 31.2 | TL-100, Optima™ TL, Optima TLX Tabletop, Optima MAX, Optima MAX-E |
| **TLV-100** | 100,000 | 400,000 | 9 | 8 x 2.0 | 16 | TL-100, Optima™ TL, Optima TLX Tabletop, 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 |




## Fixed-Angle Rotor, Titanium

For use in the TL-100, Optima™ TL, Optima TLX Tabletop, and Optima MAX 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, 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 x 2.0 mL<br>11 x 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®** | 344625 | 50 | 2.0 | 11 x 32 | 344674 | ——— | 627,000 | 16 | 120,000 |
| **Polyallomer** | 344624 | 50 | ***1.5*** | 11 x 25 | ***344636*** | ——— | 627,000 | 14 | 120,000 |
| **Thickwall Polyallomer** | 347287 | 100 | 1.0 | 11 x 34 | ——— | ——— | 279,000 | 18 | 80,000 |
| **Thickwall Polycarbonate** | 343778 | 100 | 1.0 | 11 x 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

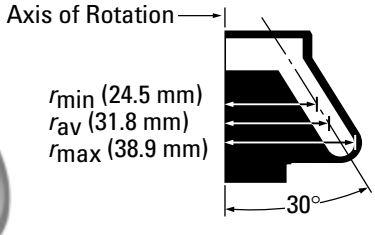
301875 Spacer Removal Tool
348305 Tube Rack for 11-mm Tubes (included with Rotor Package)
342488 Quick-Seal Tube Rack (Tube Rack Adapters required)
362100 Tube Rack Adapter (set/8) for sealing Tubes 344624
362101 Tube Rack Adapter (set/8) for sealing Tubes 344625
346133 Rotor Vise Assembly
349387 Tube Topper Rack for 11-mm Tubes
927208 Hemostats, 6-in. curved
345531 Quick-Seal Starter Kit, 11 x 25 mm, 2.0 mL Tubes. Includes 10 each 344636 Spacers, box of 344624 Tubes and 8 each Adapters. 342488 Tube Rack required.
345532 Quick-Seal Starter Kit, 11 x 32 mm, 2.0 mL Tubes. Includes 10 each 344674 Spacers, box of 344625 Tubes and 8 each 344644 Adapters. 342488 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 Tabletop, and Optima MAX 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<br>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

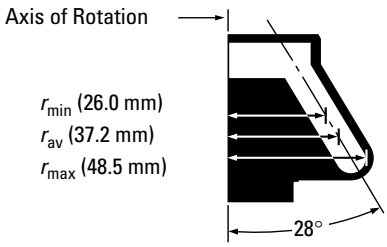
| Tube Style/Material | Part No. | Quantity | Vol.(mL) | Size g-Max | Floating (mm) | Adapters Spacers | g-Force | k Factor | Max. Speed |
|---|---|---|---|---|---|---|---|---|---|
| **Thickwall Polyallomer** | 343777 | 100 | 0.5 | 8 x 34 | ——— | ——— | 279,000 | 18 | 80,000 |
| **Thickwall Polycarbonate** | 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 Tabletop, 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 | Rotor Capacity Volume/Size |
|---|---|---|---|---|
| 110,000 | 657,000 | 13 | 8 x 5.1 mL<br>13 x 51 mm | 40.8 mL |

**No. 366735.** TLA-110 Fixed-Angle Rotor Package. Includes Rotor, one box of 362248 Polyallomer Quick-Seal® Bell Top Tubes, one package of eight each 362307 Floating Spacers, 854519 and 824412 O-ring, 348122 Rack Assembly, 927208 Hemostats, 306812 Spincote™ 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

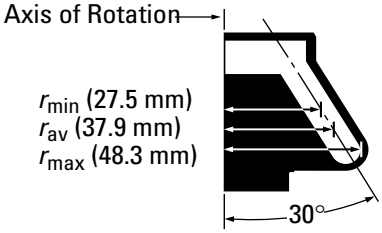
338765 Spacer Removal Tool for 3.5-mL and 2.0-mL Quick-Seal Tube Spacers
355872 Tube Rack for 13-mm Tubes (included in Rotor Package)
348122 Tube Topper Rack for 13-mm Tubes
342423 Tube Rack for 13 x 51 mm Quick-Seal Tubes
342488 Tube Rack for *g*-Max® Quick-Seal Tubes
355582 Tube Rack Adapter for 13 x 32 mm, 3.5-mL Quick-Seal Tubes for use in 342488 Tube Rack
345832 Tube Rack Adapter for 13 x 25 mm, 2.0-mL Quick-Seal Tubes for use in 342488 Tube Rack
347404 Rotor Cleaning Brush
927208 Hemostats, 6-in. curved

### Rotor Replacement Parts

366732 Rotor Lid Assembly
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 Tabletop, and Optima MAX 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 x 3.5 mL<br>13 x 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®** | 349621 | 50 | 3.5 | 13 x 32 | 355937 | ——— | 541,000 | 14 | 100,000 |
| **Polyallomer** | 345829 | 50 | ***2.0*** | 13 x 25 | ***360270*** | ——— | 541,000 | 11 | 100,000 |
| **Thickwall Polyallomer** | 349623 | 25 | 3.0 | 13 x 51 | ——— | ——— | 265,000 | 34 | 70,000 |
| **Thickwall Polycarbonate** | 349622 | 25 | 3.0 | 13 x 51 | ——— | ——— | 541,000 | 16 | 100,000 |
| **Microcentrifuge Polyallomer** | 357448 | 500 | 1.5 | 11 x 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

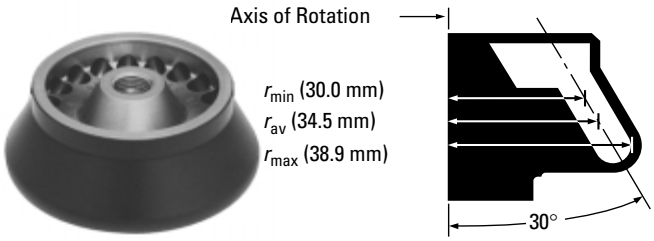
338765 Spacer Removal Tool for 3.5-mL and 2.0-mL Quick-Seal Tube Spacers
355872 Tube Rack for 13-mm Tubes (included in Rotor Package)
348122 Tube Topper Rack for 13-mm Tubes
354526 CentriTube Slicer Adapter for 13-mm Tubes
342488 Tube Rack for Quick-Seal Tube Sealer, 8-place (Adapters required)
355582 Tube Rack Adapter for 13 x 32 mm, 3.5-mL Quick-Seal Tubes for use in 342488 Tube Rack
345832 Tube Rack Adapter for 13 x 25 mm, 2.0-mL Quick-Seal Tubes for use in 342488 Tube Rack
347404 Rotor Cleaning Brush

### Rotor Replacement Parts

349478 Rotor Lid Assembly
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 Tabletop, and Optima MAX 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<br>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

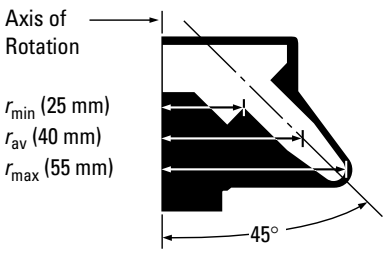
| Tube Style/Material | Part No. | Quantity | Vol.(mL) | Size g-Max | Floating (mm) | Adapters Spacers (qty. 1) | g-Force (qty. 1) | k Factor | Max. Speed |
|---|---|---|---|---|---|---|---|---|---|
| **Thickwall Polyallomer** | 343621 | 100 | 0.2 | 7 x 20 | ——— | ——— | 279,000 | 10 | 80,000 |
| **Thickwall 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 Tabletop, 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<br>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 Hemstats, 306812 Spincote ™ 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 |

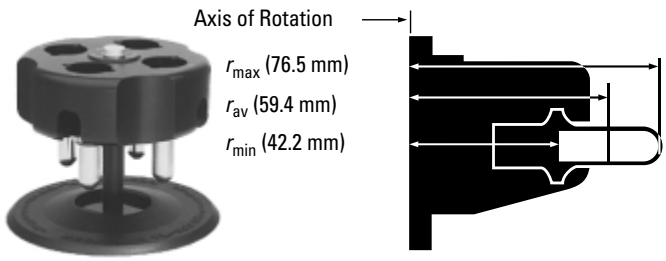
**Package of eight.*

### 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




## Swinging-Bucket Rotor, Titanium

For use in the TL-100, Optima™ TL, Optima TLX Tabletop, and Optima MAX 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<br>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, four 841648 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®** | 344625 | 50 | 2.0 | 11 x 32 | 344674 | ——— | 259,000 | 50 | 55,000 |
| **Polyallomer** | 344624 | 50 | 1.5 | 11 x 25 | 344674 | ——— | 259,000 | 37 | 55,000 |
| **Thinwall** | 347357 | 50 | 2.2 | 11 x 34 | ——— | ——— | 259,000 | 50 | 55,000 |
| **Polyallomer** | 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** | 343778 | 100 | 1.4 | 11 x 34 | ——— | ——— | 259,000 | 50 | 55,000 |
| **Polycarbonate** | 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

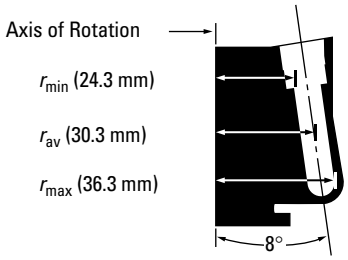
348305 Tube Rack for 11-mm Tubes (included with Rotor Package)
342488 Quick-Seal Tube Rack (Tube Rack Adapters required)
362100 Tube Rack Adapters, set/8, for 344624 11 x 25 mm Quick-Seal Tubes
362101 Tube Rack Adapters, set/8, for 344625 11 x 25 mm Quick-Seal Tubes
349387 Tube Topper Rack for 11-mm Tubes
927208 Hemostats, 6-in. curved
347404 Rotor Cleaning Brush

### Rotor Replacement Parts

345773 Rotor Stand
346364 Replacement Bucket Set, set/4
841648 Bucket O-ring
345770 Cap Assembly, Bucket (each)
347358 Bucket Stand
349338 Cap & Plunger Assy.

### Adapters/Spacers

358614 358615 344674




## NVT™ Near-Vertical Rotor, Titanium

For use in the TL-100, Optima™ TL, Optima TLX Tabletop, and Optima MAX 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 x 1.2 mL<br>8 x 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, 347372 Hex-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 x 35 | 361061 | ——— | 585,000 | 7 | 120,000 |

**To accomodate 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, 120V sealer)
345530 Quick-Seal Tube Sealing Kit (50 Hz, 220V 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
347372 Hex-plug Adapter
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
349339 Cap and Plunger Assembly

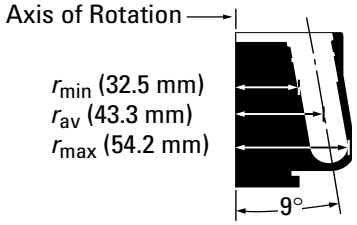
***For Rotors Manufactured After 1/2000***

368550 Rotor Plug Replacement (set of 8)
347371 Rotor Plug Gasket
347373 Rotor Vise
349339 Cap and Plunger Assembly
368544 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 Tabletop, and Optima MAX 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 x 3.9 mL<br>13 x 38 mm | 31.2 mL |

**No. 357614.** TLN-100 Near-Vertical Rotor Package. Includes Rotor, 2 boxes 358980 Quick-Seal® Polyallomer Tubes, 347402 Foam Vise Tape, 355872 Tube Rack, 359392 Quick-Seal Tube Rack, 347373 Rotor Vise, 306812 Spinkote™ Lubricant, 335148 Vacuum Grease, 12 each 342882 Sealing Washers, 10 each 342883 Spacers, 356306 Wrench Adapter, 85812 Torque Wrench, and 927108 Hemostat.

**OptiSeal Tube Kit: No. 361664.** Includes 4 boxes of 361627 Tubes, 8 each 362198 Spacers, 361650 OptiSeal™ Tube Rack, and 361668 Tube Extraction Tool.

### 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 x 33 | 362198 | ——— | 450,000 | 14 | 100,000 |
| **Quick-Seal Polyallomer** | 358980 | 50 | 3.9 | 13 x 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
356306 Hex-plug Adapter for Torque Wrench
359392 Quick-Seal Tube Sealing Rack, 13 x 38 mm (included with package)
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

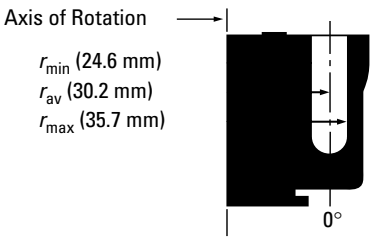
***For Rotors Manufactured After 1/2000***

368548 Rotor Plug Replacement (set of 8)
342882 Rotor Plug Gasket
347373 Rotor Vise
347402 Rotor Vise Mounting Tape (replacement)
349339 Cap and Plunger Assembly
368544 Torx Adapter

† *If replacing all rotor plugs, use Torx style, P/N 368548.*

### Adapters/Spacers

342883 362198




## Vertical-Tube Rotor, Titanium

For use in the TL-100, Optima™ TL, Optima TLX Tabletop, and Optima MAX 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<br>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, 342488 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

342488 Tube Rack for 11-mm Tubes (included with Rotor Package)
362101 Tube Rack Adapter for sealing 11 x 32 mm Tubes in Tube Rack 342488
348305 Tube Rack
355872 Tube Topper Rack for 11-mm Tubes
347373 Rotor Vise
347402 Foam Vise Mounting Tape
347404 Rotor Cleaning Brush
858121 Torque Wrench
347372 Hex-plug Adapter for 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
349339 Cap and Plunger Assembly

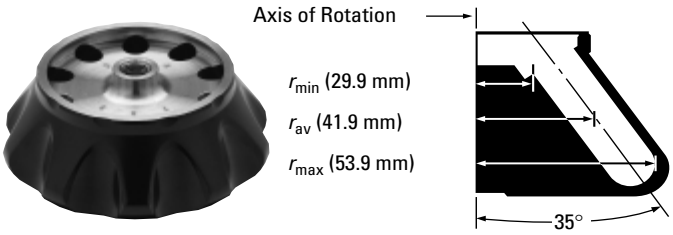
***For Rotors Manufactured After 1/2000***

368550 Rotor Plug Replacement (set of 8)
347371 Rotor Plug Gasket
347370 Quick-Seal Tube Spacers
349339 Cap and Plunger Assembly
368544 Torx Adapter

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

### Adapters/Spacers

347370




## 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<br>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 Spincote™ Lubricant and 335148 Vacuum Grease.

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

### Rotor Replacement Parts

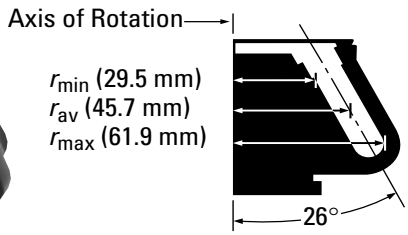
346133 Rotor Vise

### 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 |

### Adapters/Spacers

367310




## Fixed-Angle Rotor, Aluminum

For use in instruments classified: **Optima™ MAX Tabletop 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<br>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 Spincote™ Lubricant and 335148 Vacuum Grease.

**No. 367087.** MLA-80 Fixed-Angle Rotor Assembly.

### Rotor Replacement Parts

892292 O-ring

### Tubes and Bottles

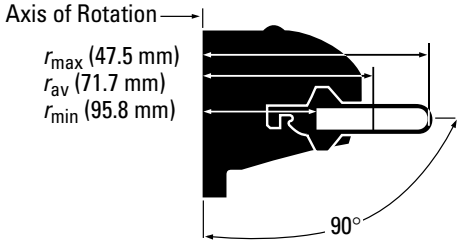
| Tube Style/Material | Part No. | Quantity | Vol. (mL) | Size (mm) | Required Caps/ Spacers (qty. 1) | Required Adapters (qty. 1) | g-Force | k factor | Max. Speed |
|---|---|---|---|---|---|---|---|---|---|
| **Quick-Seal® Polyallomer** | 344621 | 50 | 8.0 | 16 x 58 | 367094 | ——— | 444,000 | 29 | 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 |

### Adapters/Spacers

367094

# MLS-50 4 x 5 mL






## Swinging-Bucket Rotor, Titanium

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<br>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 Spincote™ 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<br>344090 | 50<br>50 | 5.0<br>0.8 | 13 x 51<br>5 x 41 | ———<br>——— | ———<br>356860 | 268,000<br>218,000 | 71<br>67 | 50,000<br>46,000 |

** Package of two.*

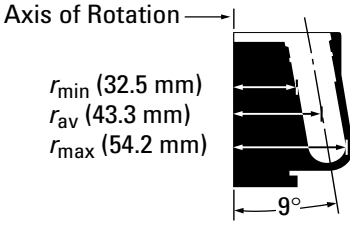
*** Package of six.*

### Rotor Replacement Parts

367278 Rotor Stand Assembly
367284 Bucket Set

### Adapters/Spacers

355535 356860 358153 361678




## 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<br>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 Spincote™ Lubricant and 335148 Vacuum Grease.

**No. 367099.** MLA-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<br>367313 | ——— | 390,000 | 18 | 80,000 |
| | 356562 | 50 | 4.2 | 16 x 38 | 349289<br>367312 | ——— | 390,000 | 16 | 80,000 |

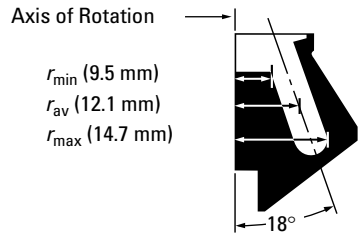
### Rotor Replacement Parts

355875 Plug, Cell
349290 Washer, Seal

### Adapters/Spacers

349289 367101 367312 367313

# A-110 — 6 x 180 µL — A-110




## Fixed-Angle Rotor, Aluminum, Red

For use in the Airfuge® 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 x 180 µL<br>5 x 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.

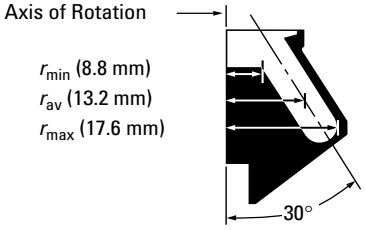
### Tubes and Bottles

| 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 x 20 | 199,000 | 9 | 110,000 |
| **Polyethylene** | 343622 | 100 | 175 | 5 x 20 | 199,000 | 9 | 110,000 |
| **Ultra-Clear™** | 344718 | 100 | 180 | 5 x 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
342707 Rotor and Tube Rack
339639 Rotor Base Bushing, white
341252 Rotor Stand/Vise

# A-100/30 — 6 x 240 µL — A-100/30




## Fixed-Angle Rotor, Aluminum, Blue

For use in Airfuge® 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 x 240 µL<br>5 x 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.

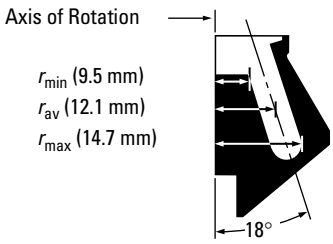
### Tubes and Bottles

| 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 x 20 | 167,000 | 19 | 92,000 |
| **Polyethylene** | 343622 | 100 | 150 | 5 x 20 | 167,000 | 19 | 92,000 |
| **Ultra-Clear™** | 344718 | 100 | 240 | 5 x 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
342707 Rotor and Tube Rack
339639 Rotor Base Bushing, white
341252 Rotor Stand/Vise

# A-100/18 — 6 x 175 µL — A-100/18




## Fixed-Angle Rotor, Aluminum, Silver

For use in the Airfuge 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 x 175 µL<br>5 x 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.

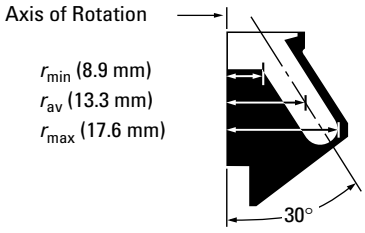
### Tubes and Bottles

| 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 x 20 | 148,000 | 12 | 95,000 |
| **Polyethylene** | 343622 | 100 | 100 | 5 x 20 | 148,000 | 12 | 95,000 |
| **Ultra-Clear** | 344718 | 100 | 175 | 5 x 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
342707 Rotor and Tube Rack
339639 Rotor Base Bushing, white
341252 Rotor Stand/Vise

# A-95 — 4 x 450 µL — A-95




## Fixed-Angle Rotor, Aluminum, Black

For use in Airfuge 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 x 450 µL<br>8 x 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 x 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
342707 Rotor and Tube Rack
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 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 |

**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® 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<br>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® Ultracentrifuge.

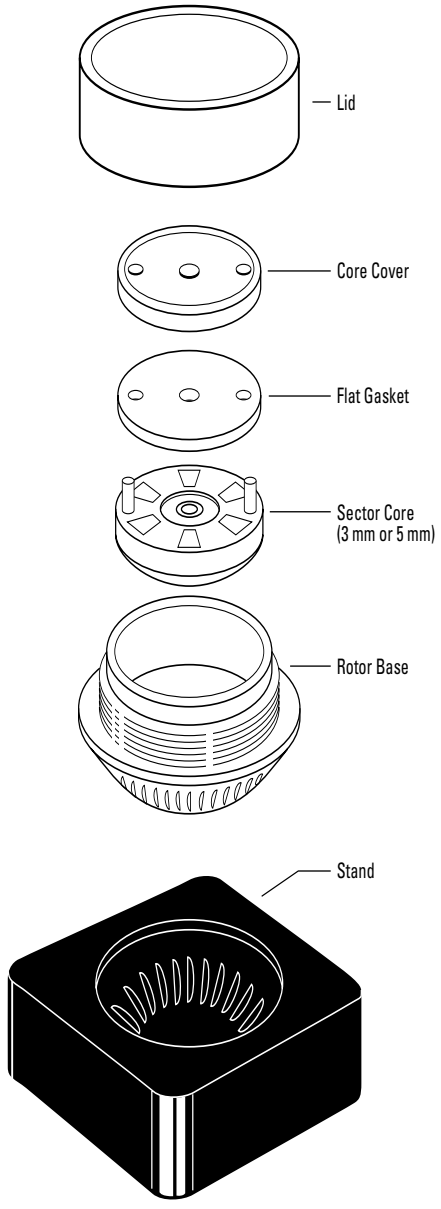
Major applications: Sedimenting particles onto filter membranes, glass cover slides, and microscope grids.

| 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" on page 2-6 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.beckman.coulter.com/Beckman/biorsrch/prodinfo/cntrifug/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.beckman.coulter.com/Beckman/biorsrch/prodinfo/cntrifug/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.

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

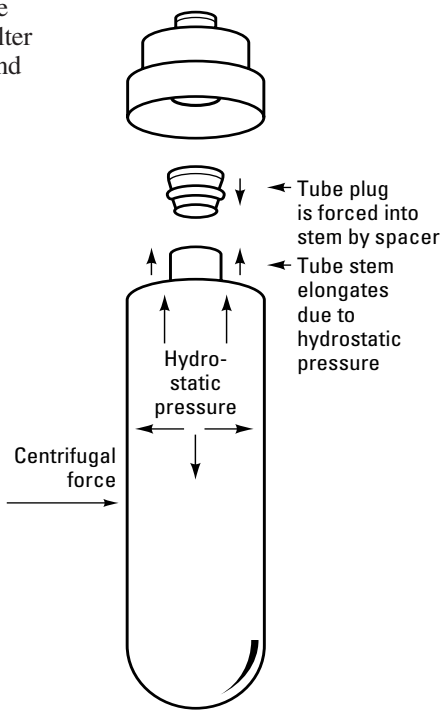
When other considerations have been resolved, convenience may be a deciding factor. Without a doubt, the most convenient tube closure is none at all; none are required for tubes run in swinging bucket rotors and in the Airfuge® Ultracentrifuge.

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.

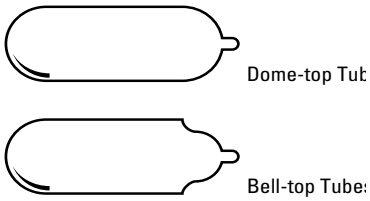
### OptiSeal™ Tubes

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, to 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, or the tabletop 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 (alphatic)** | 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 34796O) 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.*

| Nominal Filling Capacity (mL) | Nominal Size (mm) | Part No. | Rotors<br>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 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 28.1, MLA-80, MLN-80 |
| 8.0 | 16 x 58 | 344621 | Type 50, VTi 65.1, 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 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 28 |
| 17.0 | 16 x 102 | 356291 | 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 28 |
| 33.0 | 25 x 83 | 344623 | Types 70 Ti, 60 Ti, 55.2 Ti, 50.2 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 *k*onical® Tubes** | | | |
| 1.3 | 11 x 35 | 358655 | SW 60 Ti |
| 1.5 | 16 x 102 | 358653 | 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 28 |
| 23.0 | 25 x 76 | 358654 | SW 28 |
| 28.0 | 25 x 83 | 358651 | 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 |

| Nominal Filling Capacity (mL) | Nominal Size (mm) | Part No. | Rotors<br>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 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 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 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 28 |
| 94.0 | 38 x 102 | 345775 | Types 45 Ti, 21 |

| Nominal Filling Capacity (mL) | Nominal Size (mm) | Part No. | Rotors<br>See specific rotor pages for required spacers/adapters/accessories |
|---|---|---|---|
| **Thinwall Polyallomer, *k*onical™ 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 28.1 |
| 25.0 | 25 x 76 | 358125 | SW 28 |
| 30.0 | 25 x 89 | 358126 | 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 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 28 |
| 34.0 | 25 x 76 | 355637 | SW 25. 1 |
| 94.0 | 38 x 102 | 355628 | Types 45 Ti, 21 |

# Tubes and Bottles



| Nominal Filling Capacity (mL) | Nominal Size (mm) | Part No. | Rotors<br>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** | | | |
| 5.0 | 13 x 51 | 305588 | SW 55 Ti, SW 50.1 |
| 6.5 | 13 x 64 | 301099 | Types 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 | 303955 | Type 50 |
| 13.5 | 16 x 76 | 301108 | Types 70 Ti, 65, 60 Ti, 55.2 Ti, 50.2 Ti, 50 Ti, 45 Ti, 42.1, 40, 21 |
| 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

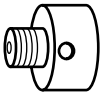
| Nominal Filling Capacity (mL) | Nominal Size (mm) | Bottle & Cap Assembly | Bottle Only | Cap Assembly | Cap Only | Plug Only | O-ring Only | Rotors |
|---|---|---|---|---|---|---|---|---|
| **Bottle and Cap Assembly** | | | | | | | | |
| PC — 8.5 | 16 x 64 | 355615 | 355656 | 355604 | 335257 | 335256 | 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 |

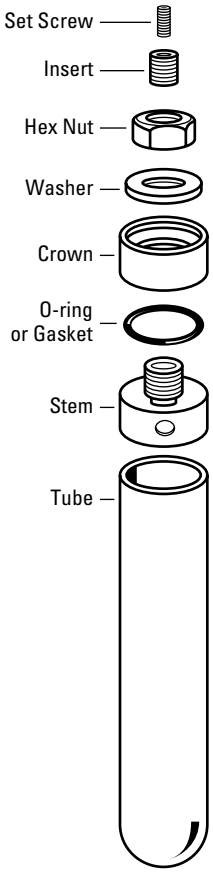
*Note: Regarding packaging, bottle and cap assemblies are packaged in units of 6, with the following exceptions: Bottle and Cap assembly 334205 is packaged as one; Bottles 355656 and 355651 are packaged in units of 25; Cap assembly 334543 is packaged as one. Caps, Plugs, and O-rings are packaged separately.*

*[1]The 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.*

*[2]The 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.*

## 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<br>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 |
| **1½ 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 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

If you're running 337927 caps in the Type 70 Ti rotor, you'll need:

**338841** Tool Kit **305075** Cap Vise

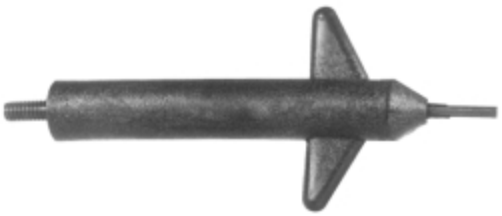
If you're running Quick-Seal® tubes, you'll need:

**342429** (60 Hz) Sealing Kit or
**342424** (50 Hz) Sealing Kit or
**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



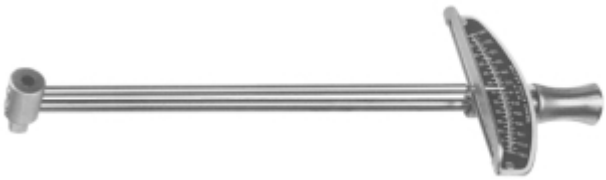
**302460** Nylon Insert Tool, for cap stem filling hole

**305075** Tube-Cap Vise

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

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

**858121** Torque Wrench



**858122** Socket Adapter, for 858123 Socket below

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

## Tools for Fixed-Angle Rotors (cont'd)

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

**878133** Removal Tool, for polycarbonate bottles with aluminum caps

**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 ¾ -in. (19 mm) hex nut
- **870432** Socket, for 7/16 -in. (11 mm) hex nut

**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 ¾ -in. (19 mm) hex nut
- **870432** Socket, for 7/16 -in. (11 mm) hex nut

**331325** Centering Tool, for replacing overspeed disk

**335381** Removal Tool, for polycarbonate bottles with Noryl caps

**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 90, NVT-65, VTi 65.1, VTi 65.2, and VAC 50 rotors

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

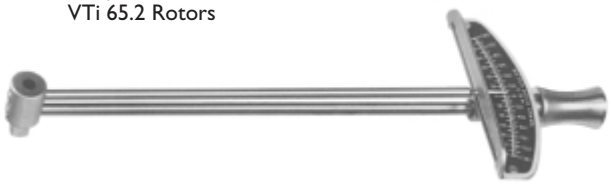
**357313** Tube Insert Vise for VC53

**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 and VTi 65.2 Rotors

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

**858121** Torque Wrench, 200 in.-lb. for VTi 90, VTi65, VTi 65.1, and VTi 65.2 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

**349291** Square Plug-wrench Adapter for VTi 65.1 Rotors

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

**354468** Removal Tool, for *konical*™ Tube Adapters

**368544** Torx Adapter for NVT 100, NVT 90, NVT 65.2, TLN-100, VTi 90, VTi 65.2, TLV-100, TLN-120

## Tools for Swinging-Bucket Rotors

**001878** Bucket Cap Tool, for SW 60 Ti Rotor

**330069** Hinge Pin Tool, for SW 25.1 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, A1-15, Ti-14 Rotors

**337883** Locating Spacer, for Z-60 Rotor

**337885** Core Assembler, for Z-60 Rotor

**819247** Lubriplate Grease, 1¾-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, 7⁄16 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 page2–19) 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

**339587** Master Rotor Logbook

## Supplies *(continued)*

**330049** Logbook, for Preparative Ultracentrifuge Instruments

**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 *konical*™ Tube Adapters used in Swinging Bucket Rotors

**342415** Funnel

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

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

**357442** Seal Formers (flat-topped) for use with Tube Sealer, and Tube Topper

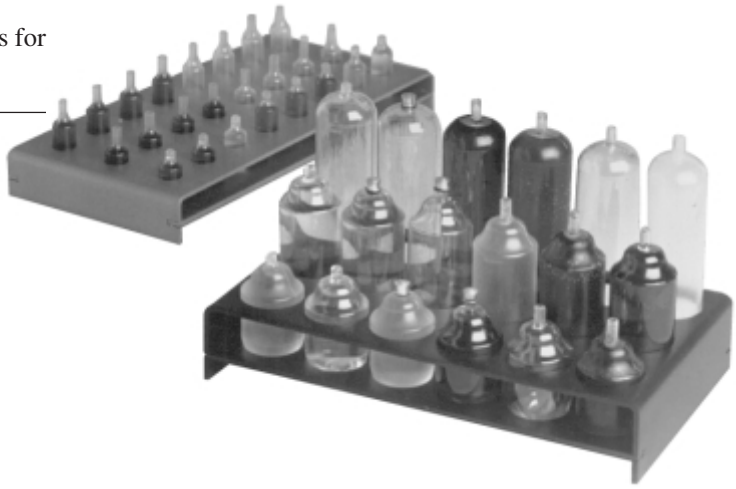
**342694** Sample Application Block


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

## Quick-Seal® Tube Racks

### For Cordless Tube Topper

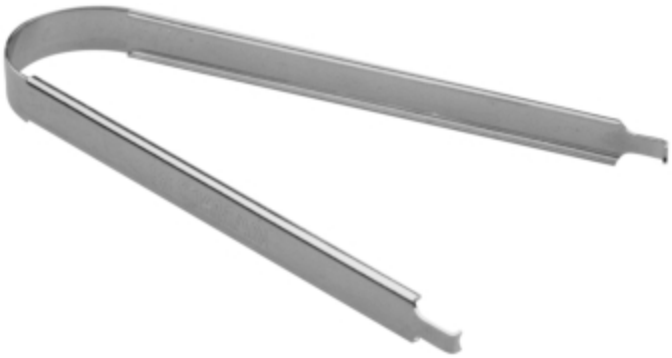
These autoclavable racks accommodate Quick-Seal Tubes for use with the Cordless Tube Topper.



**349661** Tube Rack (Orange), for 5/16-in. (8 mm) diameter Tubes
**349387** Tube Rack (Gold), for 7/16-in. (11 mm) diameter Tubes
**348122** Tube Rack (Red), for 1/2-in. (13 mm) diameter Tubes
**356568** Tube Rack (Violet), for 9/16-in. (14 mm) diameter Tubes
**348123** Tube Rack (Green), for 5/8-in. (16 mm) diameter Tubes
**348124** Tube Rack (Blue), for 1-in. (25 mm) diameter Tubes
**348125** Tube Rack (Black), for 1 1/2 -in. (38 mm) diameter Tubes

## Tools for OptiSeal™ Tubes

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



**338765** Removal Tool, for 5/8-in Floating Spacer (362202)
**360534** OptiSeal Tube Rack, for 1/2 x 2-in. (13 x 51 mm) Tubes
**360538** OptiSeal Tube Rack, for 5/8 x 2 3/4-in. (16 x 70 mm) Tubes
**360542** OptiSeal Tube Rack, for 1 x 3 1/2-in. (25 x 89 mm) Tubes
**361638** OptiSeal Tube Rack, for 1/2 x 1 7/8-in. (13 x 48 mm) Tubes
**361642** OptiSeal Tube Rack, for 5/8 x 2 3/8-in. (16 x 60 mm) Bell top Tubes
**361646** OptiSeal Tube Rack, for 1 x 3 1/4-in. (25 x 77 mm) Bell top Tubes
**361650** OptiSeal Tube Rack, for 1/2 x 1 15/16-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)
**367803** Tube Topper Kit, 60 Hz (for Canada)

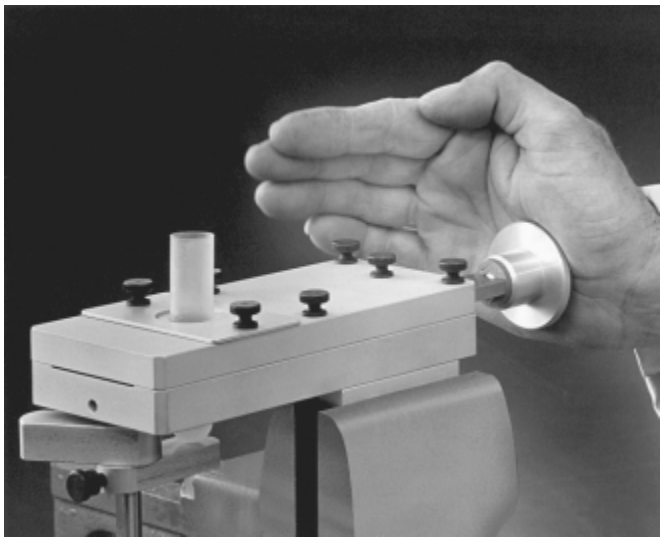
Each Kit Contains:

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
**342419** Removal Tool for Tubes and Metal Spacers
**342415** Funnels (two)
**338765** Removal Tool for Plastic Spacers and Floating Spacers
**342694** Sample Application Block
**343890** Fraction Recovery System
**348114** Replacement Instruction Label
**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, 5/16 -in. (8 mm), two required
**303924** Metal Shim Ring, 5/16 -in. (8 mm), two required
**338516** Rubber Ring, 7/16 -in. (11 mm), two required
**338517** Metal Shim Ring, 7/16 -in. (11 mm), two required
**303919** Rubber Ring, 1/2 -in. (13 mm), two required
**303923** Metal Shim Ring, 7/16 -in. (13 mm), two required
**332693** Rubber Ring, 9/16 -in. (14 mm), two required
**332692** Metal Shim Ring, 9/16 -in. (14 mm), two required
**303918** Rubber Ring, 5/8 -in. (16 mm), two required
**303922** Metal Shim Ring, 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 347955, 347956, 347957, and 354526 Adapter Plates, 348299 Blades, 889676 Storage Box, 348307 Hardware Kit, 306812 Spinkote™ Lubricant, and 347967 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
**347967** Instruction Manual (TL-TB-008)

## 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

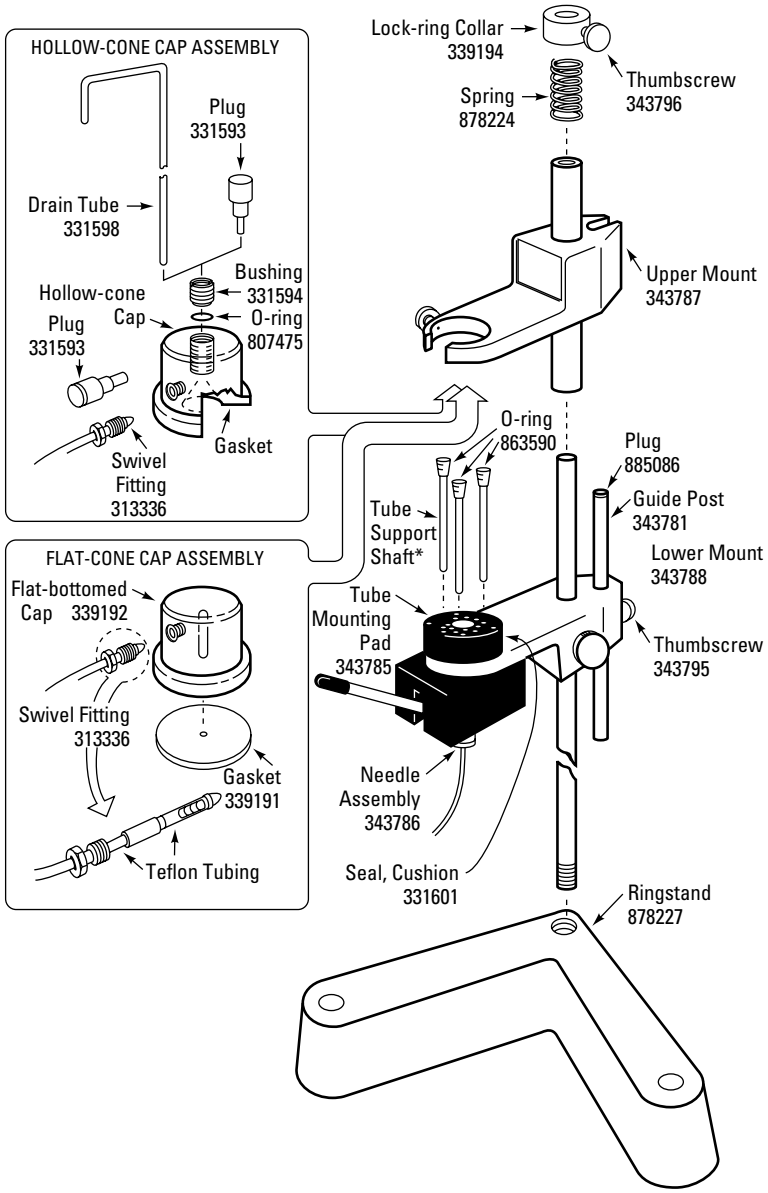
### Replacement Parts/Supplies

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

**339379** Rotor Cleaning Brush, ⅝-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, 1¼-in. (32 mm) and 1½-in. (38 mm), for Rotor Cavity diameters from 1-in. (25.4 mm) to 1½-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 ½-in. Tubes.

**342024** Fraction Recovery System with Hollow-cone Cap for ⅝-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 1¼-in. diameter Tubes

**331589** Gasket for 331563 Cap

**331564** Hollow-cone Cap for ⅝-in. diameter Tubes

**331588** Gasket for 331564 Cap

**331565** Hollow-cone Cap for ½-in. diameter Tubes

**331587** Gasket for 331565 Cap

**331566** Hollow-cone Cap for 9/16-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

**331567** Guide Bar

**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

3

## 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 | J6 | GS6 | Microfuge | Avanti™ |
| **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'd)

| 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 | J6 | GS6 | Microfuge | Avanti™ |
| **Preparative Centrifugation** | | | | | | | | | | | | | |
| **Lysates/Homogenates** | Clearing debris and large particles | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● |
| **Nucleic Acids** | | | | | | | | | | | | | |
| DNA | Alcohol precipitation | | | | | | | ● | ● | | | ● | ● |
| | Phenol/$CHCl_3$ extraction | | | | | | | ● | ● | | | ● | ● |
| | Plasmid purfication 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 | | | | | | | | | ● | ● | | |

3

## 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 ultracetrifuges, 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 ispopycnic 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.

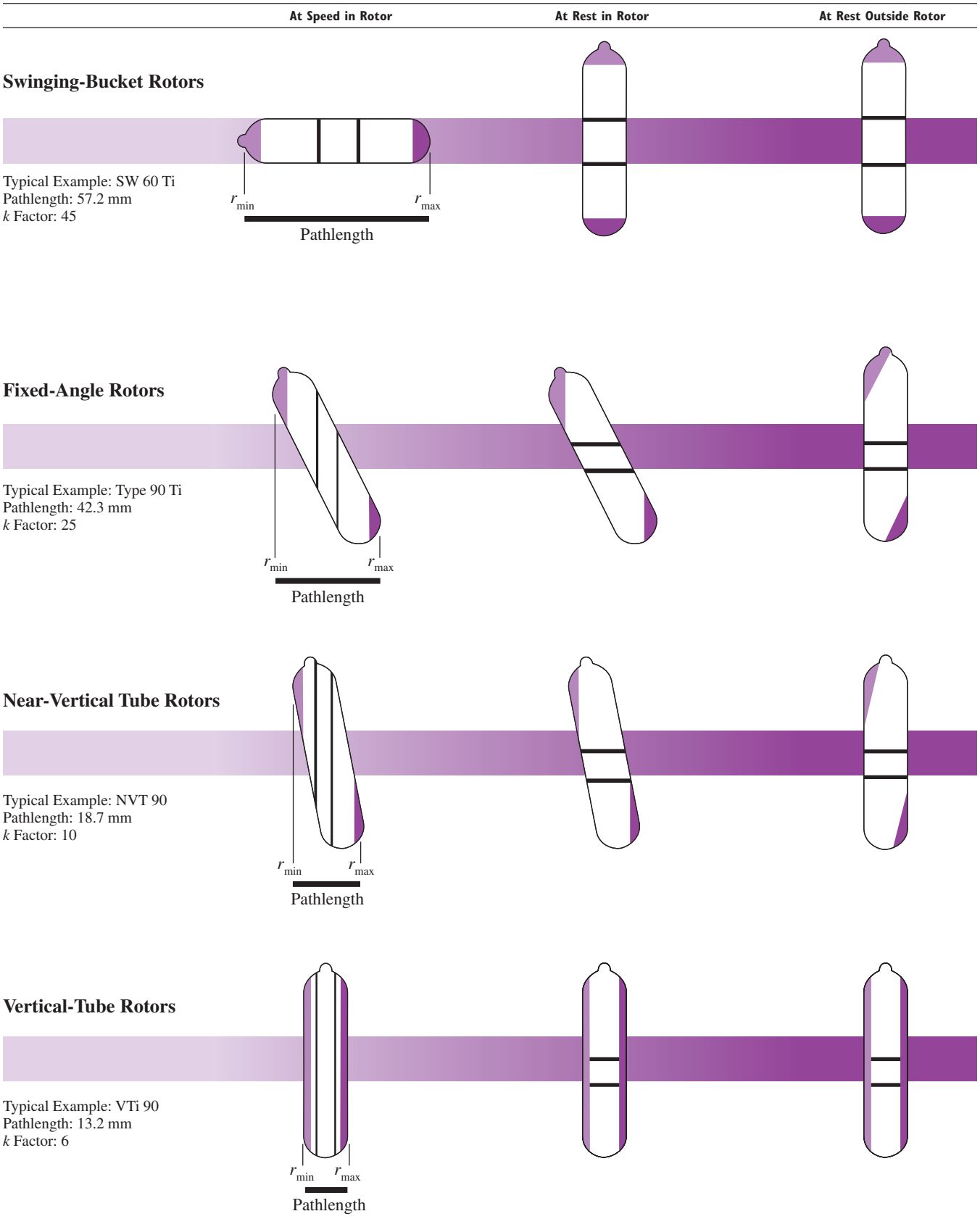
### NVT™ Near-Vertical Tube Rotors

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%) | $H_2O$ | 1.32 |
| Sucrose (65%) | $D_2O$ | 1.37 |
| Silica sols | $H_2O$ | 1.30 |
| Diodon | $H_2O$ | 1.37 |
| Glycerol | $H_2O$ | 1.26 |
| Cesium chloride | $H_2O$ | 1.91 |
| | $D_2O$ | 1.98 |
| Cesium formate | $H_2O$ | 2.10 |
| Cesium acetate | $H_2O$ | 2.00 |
| Rubidium chloride | $H_2O$ | 1.49 |
| Rubidium formate | $H_2O$ | 1.85 |
| Rubidium bromide | $H_2O$ | 1.63 |
| Potassium acetate | $H_2O$ | 1.41 |
| Potassium formate | $H_2O$ | 1.57 |
| | $D_2O$ | 1.63 |
| Sodium formate | $H_2O$ | 1.32 |
| | $D_2O$ | 1.40 |
| Lithium bromide | $H_2O$ | 1.83 |
| Lithium chloride | $D_2O$ | 1.33 |
| Albumin | $H_2O$ | 1.35 |
| Sorbitol | $H_2O$ | 1.39 |
| Ficoll | $H_2O$ | 1.17 |
| Metrizamide | $H_2O$ | 1.46 |

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

| Density (g/cm3)* | Refractive Index, $\eta_D$ | % by Weight | mg/ml of Solution** | Molarity |
|---|---|---|---|---|
| 1.0047 | 1.3333 | 1 | 10.0 | 0.056 |
| 1.0125 | 1.3340 | 2 | 20.2 | 0.119 |
| 1.0204 | 1.3348 | 3 | 30.6 | 0.182 |
| 1.0284 | 1.3356 | 4 | 41.1 | 0.244 |
| 1.0365 | 1.3364 | 5 | 51.8 | 0.308 |
| 1.0447 | 1.3372 | 6 | 62.8 | 0.373 |
| 1.0531 | 1.3380 | 7 | 73.7 | 0.438 |
| 1.0615 | 1.3388 | 8 | 84.9 | 0.504 |
| 1.0700 | 1.3397 | 9 | 96.3 | 0.572 |
| 1.0788 | 1.3405 | 10 | 107.9 | 0.641 |
| 1.0877 | 1.3414 | 11 | 119.6 | 0.710 |
| 1.0967 | 1.3423 | 12 | 131.6 | 0.782 |
| 1.1059 | 1.3432 | 13 | 143.8 | 0.854 |
| 1.1151 | 1.3441 | 14 | 156.1 | 0.927 |
| 1.1245 | 1.3450 | 15 | 168.7 | 1.002 |
| 1.1340 | 1.3459 | 16 | 181.4 | 1.077 |
| 1.1437 | 1.3468 | 17 | 194.4 | 1.155 |
| 1.1536 | 1.3478 | 18 | 207.6 | 1.233 |
| 1.1637 | 1.3488 | 19 | 221.1 | 1.313 |
| 1.1739 | 1.3498 | 20 | 234.8 | 1.395 |
| 1.1843 | 1.3508 | 21 | 248.7 | 1.477 |
| 1.1948 | 1.3518 | 22 | 262.9 | 1.561 |
| 1.2055 | 1.3529 | 23 | 277.3 | 1.647 |
| 1.2164 | 1.3539 | 24 | 291.9 | 1.734 |
| 1.2275 | 1.3550 | 25 | 306.9 | 1.823 |
| 1.2387 | 1.3561 | 26 | 322.1 | 1.913 |
| 1.2502 | 1.3572 | 27 | 337.6 | 2.005 |
| 1.2619 | 1.3584 | 28 | 353.3 | 2.098 |
| 1.2738 | 1.3596 | 29 | 369.4 | 2.194 |
| 1.2858 | 1.3607 | 30 | 385.7 | 2.291 |
| 1.298 | 1.3619 | 31 | 402.4 | 2.390 |
| 1.311 | 1.3631 | 32 | 419.5 | 2.492 |
| 1.324 | 1.3644 | 33 | 436.9 | 2.595 |
| 1.336 | 1.3657 | 34 | 454.2 | 2.698 |
| 1.3496 | 1.3670 | 35 | 472.4 | 2.806 |
| 1.363 | 1.3683 | 36 | 490.7 | 2.914 |
| 1.377 | 1.3696 | 37 | 509.5 | 3.026 |
| 1.391 | 1.3709 | 38 | 528.6 | 3.140 |
| 1.406 | 1.3722 | 39 | 548.3 | 3.257 |
| 1.4196 | 1.3735 | 40 | 567.8 | 3.372 |
| 1.435 | 1.3750 | 41 | 588.4 | 3.495 |
| 1.450 | 1.3764 | 42 | 609.0 | 3.617 |
| 1.465 | 1.3778 | 43 | 630.0 | 3.742 |
| 1.481 | 1.3792 | 44 | 651.6 | 3.870 |
| 1.4969 | 1.3807 | 45 | 673.6 | 4.001 |
| 1.513 | 1.3822 | 46 | 696.0 | 4.134 |
| 1.529 | 1.3837 | 47 | 718.6 | 4.268 |
| 1.546 | 1.3852 | 48 | 742.1 | 4.408 |
| 1.564 | 1.3868 | 49 | 766.4 | 4.552 |
| 1.5825 | 1.3885 | 50 | 791.3 | 4.700 |
| 1.601 | 1.3903 | 51 | 816.5 | 4.849 |
| 1.619 | 1.3920 | 52 | 841.9 | 5.000 |
| 1.638 | 1.3937 | 53 | 868.1 | 5.156 |
| 1.658 | 1.3955 | 54 | 895.3 | 5.317 |
| 1.6778 | 1.3973 | 55 | 922.8 | 5.481 |
| 1.699 | 1.3992 | 56 | 951.4 | 5.651 |
| 1.720 | 1.4012 | 57 | 980.4 | 5.823 |
| 1.741 | 1.4032 | 58 | 1009.8 | 5.998 |
| 1.763 | 1.4052 | 59 | 1040.2 | 6.178 |
| 1.7846 | 1.4072 | 60 | 1070.8 | 6.360 |
| 1.808 | 1.4093 | 61 | 1102.9 | 6.550 |
| 1.831 | 1.4115 | 62 | 1135.8 | 6.746 |
| 1.856 | 1.4137 | 63 | 1167.3 | 6.945 |
| 1.880 | 1.4160 | 64 | 1203.2 | 7.146 |
| 1.9052 | 1.4183 | 65 | 1238.4 | 7.355 |

*Density data are from International Critical Tables.*

**Computed from the relationship $p^{25} = 10.2402\ h_D^{25}$—12.6483 for densities between 1.00 and 1.38, and $p^{25} = /0.8601\ h_D^{25}$—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/cm3) | Refractive Index, $\eta_D$ | % by Weight | mg/ml of Solution* | Molarity |
|---|---|---|---|---|
| 0.9982 | 1.3330 | 0 | | |
| 1.0021 | 1.3344 | 1 | 10.0 | 0.029 |
| 1.0060 | 1.3359 | 2 | 20.1 | 0.059 |
| 1.0099 | 1.3374 | 3 | 30.3 | 0.089 |
| 1.0139 | 1.3388 | 4 | 40.6 | 0.119 |
| 1.0179 | 1.3403 | 5 | 50.9 | 0.149 |
| 1.0219 | 1.3418 | 6 | 61.3 | 0.179 |
| 1.0259 | 1.3433 | 7 | 71.8 | 0.210 |
| 1.0299 | 1.3448 | 8 | 82.4 | 0.211 |
| 1.0340 | 1.3464 | 9 | 93.1 | 0.272 |
| 1.0381 | 1.3479 | 10 | 103.8 | 0.303 |
| 1.0423 | 1.3494 | 11 | 114.7 | 0.335 |
| 1.0465 | 1.3510 | 12 | 125.6 | 0.367 |
| 1.0507 | 1.3526 | 13 | 136.6 | 0.399 |
| 1.0549 | 1.3541 | 14 | 147.7 | 0.431 |
| 1.0592 | 1.3557 | 15 | 158.9 | 0.464 |
| 1.0635 | 1.3573 | 16 | 170.2 | 0.497 |
| 1.0678 | 1.3590 | 17 | 181.5 | 0.530 |
| 1.0721 | 1.3606 | 18 | 193.0 | 0.564 |
| 1.0765 | 1.3622 | 19 | 204.5 | 0.597 |
| 1.0810 | 1.3639 | 20 | 216.2 | 0.632 |
| 1.0854 | 1.3655 | 21 | 227.9 | 0.666 |
| 1.0899 | 1.3672 | 22 | 239.8 | 0.701 |
| 1.0944 | 1.3689 | 23 | 251.7 | 0.735 |
| 1.0990 | 1.3706 | 24 | 263.8 | 0.771 |
| 1.1036 | 1.3723 | 25 | 275.9 | 0.806 |
| 1.1082 | 1.3740 | 26 | 288.1 | 0.842 |
| 1.1128 | 1.3758 | 27 | 300.5 | 0.878 |
| 1.1175 | 1.3775 | 28 | 312.9 | 0.914 |
| 1.1222 | 1.3793 | 29 | 325.4 | 0.951 |
| 1.1270 | 1.3811 | 30 | 338.1 | 0.988 |
| 1.1318 | 1.3829 | 31 | 350.9 | 1.025 |
| 1.1366 | 1.3847 | 32 | 363.7 | 1.063 |
| 1.1415 | 1.3865 | 33 | 376.7 | 1.100 |
| 1.1463 | 1.3883 | 34 | 389.7 | 1.138 |
| 1.1513 | 1.3902 | 35 | 403.0 | 1.177 |
| 1.1562 | 1.3920 | 36 | 416.2 | 1.216 |
| 1.1612 | 1.3939 | 37 | 429.6 | 1.255 |
| 1.1663 | 1.3958 | 38 | 443.2 | 1.295 |
| 1.1713 | 1.3978 | 39 | 456.8 | 1.334 |
| 1.1764 | 1.3997 | 40 | 470.6 | 1.375 |
| 1.1816 | 1.4016 | 41 | 484.5 | 1.415 |
| 1.1868 | 1.4036 | 42 | 498.5 | 1.456 |
| 1.1920 | 1.4056 | 43 | 512.6 | 1.498 |
| 1.1972 | 1.4076 | 44 | 526.8 | 1.539 |
| 1.2025 | 1.4096 | 45 | 541.1 | 1.581 |
| 1.2079 | 1.4117 | 46 | 555.6 | 1.623 |
| 1.2132 | 1.4137 | 47 | 570.2 | 1.666 |
| 1.2186 | 1.4158 | 48 | 584.9 | 1.709 |
| 1.2241 | 1.4179 | 49 | 599.8 | 1.752 |
| 1.2296 | 1.4200 | 50 | 614.8 | 1.796 |
| 1.2351 | 1.4221 | 51 | 629.9 | 1.840 |
| 1.2406 | 1.4242 | 52 | 645.1 | 1.885 |
| 1.2462 | 1.4264 | 53 | 660.5 | 1.930 |
| 1.2519 | 1.4285 | 54 | 676.0 | 1.975 |
| 1.2575 | 1.5307 | 55 | 691.6 | 2.020 |
| 1.2632 | 1.4329 | 56 | 707.4 | 2.067 |
| 1.2690 | 1.4351 | 57 | 723.3 | 2.113 |
| 1.2748 | 1.4373 | 58 | 739.4 | 2.160 |
| 1.2806 | 1.4396 | 59 | 755.6 | 2.207 |
| 1.2865 | 1.4418 | 60 | 771.9 | 2.255 |
| 1.2924 | 1.4441 | 61 | 788.3 | 2.303 |
| 1.2983 | 1.4464 | 62 | 804.9 | 2.351 |
| 1.3043 | 1.4486 | 63 | 821.7 | 2.401 |
| 1.3103 | 1.4509 | 64 | 838.6 | 2.450 |
| 1.3163 | 1.4532 | 65 | 855.6 | 2.500 |
| 1.3224 | 1.4558 | 66 | 872.8 | 2.550 |
| 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 | $Cs_2SO_4$ | $CsNO_3$ | RbCl | RbBr | RbI | $Rb_2SO_4$ | $RbNO_3$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 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*)

$$t = \frac{k}{s}$$ where $s$ = 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

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

### 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:

$S = 10^{-13}$ seconds

### Reduced run speed for dense solutions:

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

where A = max. permissable 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.