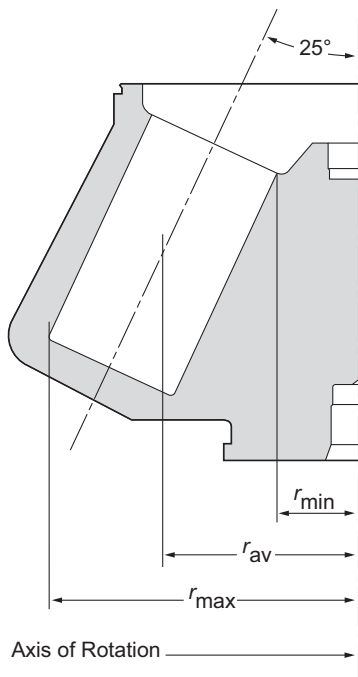


INSTRUCTIONS FOR USING THE TYPE 19 ROTOR

In Beckman Coulter Class H, R, and S Preparative Ultracentrifuges



SPECIFICATIONS

Maximum speed.....	19 000 rpm
Density rating at maximum speed	1.2 g/mL
Relative Centrifugal Field* at maximum speed	
At r_{\max} (133.4 mm).....	$53\,900 \times g$
At r_{av} (83.9 mm)	$33\,900 \times g$
At r_{\min} (34.4 mm)	$13\,900 \times g$
k factor at maximum speed	951
Conditions requiring speed reductions.....	see RUN SPEEDS
Number of rotor cavities	6
Available bottle:	
Nominal dimensions.....	60×121 mm
Nominal capacity	250 mL
Nominal rotor capacity.....	1500 mL
Approximate acceleration time to maximum	
speed (rotor fully loaded)	12 min
Approximate deceleration time from maximum	
speed (rotor fully loaded)	13 min
Weight of fully loaded rotor	17 kg (38 lb)
Rotor material	aluminum

* Relative Centrifugal Field (RCF) is the ratio of the centrifugal acceleration at a specified radius and speed ($r\omega^2$) to the standard acceleration of gravity (g) according to the following formula:

$$\text{RCF} = \frac{r\omega^2}{g}$$

where r is the radius in millimeters, ω is the angular velocity in radians per second ($2\pi\text{RPM}/60$), and g is the standard acceleration of gravity (9807 mm/s^2). After substitution:

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

DESCRIPTION

This Beckman Coulter rotor has been manufactured in a registered ISO 9001 or 13485 facility for use with the appropriately classified Beckman Coulter ultracentrifuge.

The Type 19, rated for 19 000 rpm, is a fixed angle rotor with a tube angle of 25 degrees from the axis of rotation. The rotor can hold up to six 250-mL bottles for centrifugation and is used in Beckman Coulter class H, R, and S ultracentrifuges. This rotor develops centrifugal forces for processing biological materials. Up to 1500 mL of gradient and sample volume can be centrifuged per run.

The rotor is made of aluminum, anodized for corrosion resistance. The rotor body and lid are black-anodized; the handle is clear-anodized aluminum. A flat gasket in the lid and a lubricated Buna N O-ring in the rotor body maintain atmospheric pressure inside the rotor during centrifugation. Because of the weight of the rotor, no drive pins are required in the rotor drive hole.

For overspeed protection, rotor speeds exceeding 19 000 rpm will be detected in Beckman Coulter ultracentrifuges. A 94-sector overspeed disk on the bottom of the rotor is part of the photoelectric overspeed detection system.

See the Warranty at the back of this manual for warranty information.

PREPARATION AND USE

Specific information about the Type 19 fixed angle rotor is given here. Information common to this and other rotors is contained in Rotors and Tubes for Preparative Ultracentrifuges (publication LR-IM), which should be used together with this manual for complete rotor and accessory operation.

NOTE

Although rotor components and accessories made by other manufacturers may fit in the Type 19 rotor, their safety in this rotor cannot be ascertained by Beckman Coulter. Use of other manufacturers' components or accessories in the Type 19 rotor may void the rotor warranty and should be prohibited by your laboratory safety officer. Only the components and accessories listed in this publication should be used in this rotor.

BOTTLE ASSEMBLY

The Type 19 rotor is operated with the 250-mL polyallomer bottle assembly (see Figure 1). The cap assembly comprises a Delrin¹ cap, Noryl² plug, and a Buna N O-ring.

Temperature Limits

Polyallomer bottle assemblies may be centrifuged at temperatures between 2 and 20°C (unless the sample material has an adverse effect on tube material), but they should be pretested under anticipated run conditions. If samples have been frozen in polyallomer bottles, make sure bottle and sample are thawed to at least 2°C before centrifuging. Refer to *Rotors and Tubes* for information on the chemical resistances of bottle and accessory materials.

Preparing Bottle and Cap Assemblies

1. Fill bottles to the base of the bottle neck threads. Bottles in opposite positions in the rotor must be filled with the same density and amount of solution. If an extra bottle is needed to make a symmetrical load, fill it with a solution of density equal to that of the sample solution.
2. Make sure that caps, O-rings, plugs, and bottle necks are dry and free of lubrication during assembly. Place an O-ring around the bottom of each plug, and put plugs into the filled bottles (Fluid should not come into contact with the O-ring.)
3. Inspect caps before use as described in *Rotors and Tubes*. Firmly screw the caps on by hand.

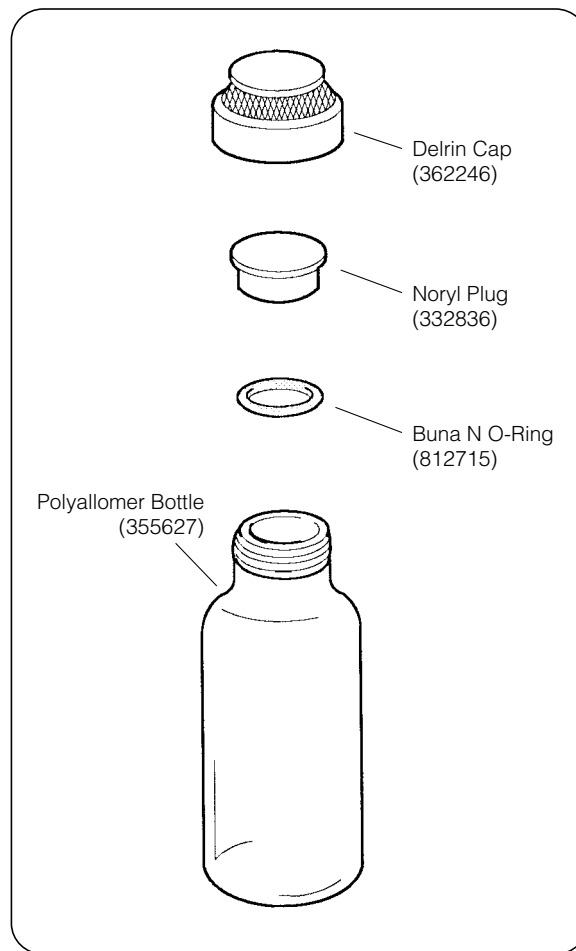


Figure 1. Bottle and Cap Assembly

¹ Registered trademark of E. I. Du Pont de Nemours & Co.

² Registered trademark of General Electric.

ROTOR PREPARATION

For runs at other than room temperature, refrigerate or warm the rotor beforehand for fast equilibration.

1. Before using the rotor, make certain that it is equipped with the correct overspeed disk (330331). Refer to the instructions in *Rotors and Tubes* to replace a missing or damaged overspeed disk.
2. Be sure that metal threads in the rotor are lightly but evenly lubricated with Spinkote™ lubricant (306812) and the rotor O-ring is lightly but evenly coated with silicone vacuum grease (335148).

NOTE _____
Keep rotor cavities and bottle exteriors clean and dry during loading.

3. Load the filled and capped bottles symmetrically into the rotor. See Figure 2.

NOTE _____
The lid gasket requires no lubrication.

4. Place the lid on the rotor and use the handle to firmly tighten it (clockwise) by hand.

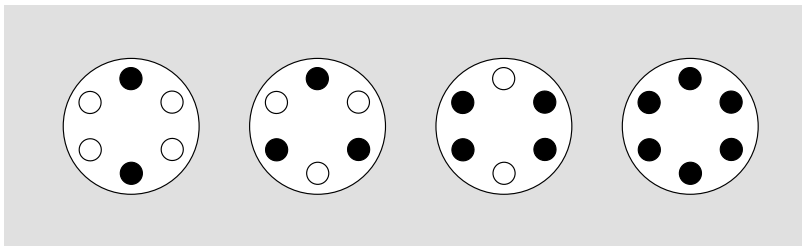


Figure 2. Arranging Tubes in the Rotor. Two, three, four, or six tubes can be centrifuged per run, if they are arranged in the rotor as shown.

OPERATION

1. Carefully place the rotor on the drive hub.
2. Refer to the applicable instrument manual for ultracentrifuge operation.

REMOVAL AND SAMPLE RECOVERY**CAUTION**

If disassembly reveals evidence of leakage, you should assume that some fluid escaped the rotor. Apply appropriate decontamination procedures to the centrifuge and accessories.

1. Remove the rotor from the instrument.
2. Remove the rotor lid by using the handle to unscrew it (counterclockwise) by hand.
3. Use the extraction tool (335353) to remove the bottles. Bottles may also be removed by hand.

RUN TIMES

The k factor of the rotor is a measure of the rotor's pelleting efficiency. (Beckman Coulter has calculated the k factors for all of its preparative rotors at maximum rated speed and using full tubes.) The k factor is calculated from the formula:

$$k = \frac{\ln(r_{\max}/r_{\min})}{\omega^2} \times \frac{10^{13}}{3600} \quad (1)$$

where ω is the angular velocity of the rotor in radians per second ($\omega = 0.105 \times \text{rpm}$), r_{\max} is the maximum radius, and r_{\min} is the minimum radius.

After substitution:

$$k = \frac{(2.533 \times 10^{11}) \ln(r_{\max}/r_{\min})}{\text{rpm}^2} \quad (2)$$

Use the k factor in the following equation to estimate the run time t (in hours) required to pellet particles of known sedimentation coefficient s (in Svedberg units, S).

$$t = \frac{k}{s} \quad (3)$$

Run times can be estimated for centrifugation at less than maximum speed by adjusting the k factor as follows:

$$k_{\text{adj}} = k \left(\frac{19\,000}{\text{actual run speed}} \right)^2 \quad (4)$$

Run times can also be estimated from data established in prior experiments if the k factor of the previous rotor is known. For any two rotors, a and b:

$$\frac{t_a}{t_b} = \frac{k_a}{k_b} \quad (5)$$

For more information on k factors see *Use of k Factor for Estimating Run Times from Previously Established Run Conditions* (publication DS-719).

RUN SPEEDS

The centrifugal force at a given radius in a rotor is a function of run speed. Comparisons of forces between different rotors are made by comparing the rotors' relative centrifugal fields (RCF). When rotational speed is adjusted so that identical samples are subjected to the same RCF in two different rotors, the samples are subjected to the same force. The RCF at a number of rotor speeds is provided in the Table.

Do not select rotational speeds that exceed 19 000 rpm. In addition, speeds must be reduced under the following circumstances:

If nonprecipitating solutions more dense than 1.2 g/mL are centrifuged, the maximum allowable run speed must be reduced according to the following equation:

$$\text{reduced maximum speed} = (19\,000 \text{ rpm}) \sqrt{\frac{1.2 \text{ g/mL}}{\text{density of bottle contents}}} \quad (6)$$

This speed reduction will protect the rotor from excessive stresses due to the added tube load.

CARE AND MAINTENANCE

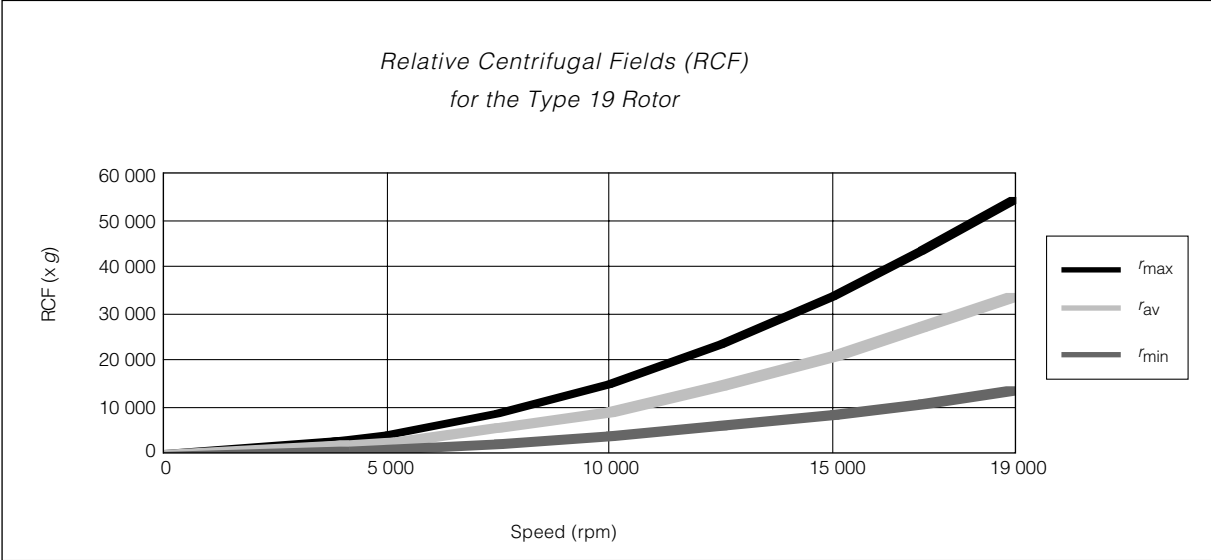
MAINTENANCE

- Regularly inspect the overspeed disk. If it is scratched, damaged, or missing, replace it according to the instructions in *Rotors and Tubes*.

*Relative Centrifugal Fields for the Type 19 Rotor.
 Entries in this table are calculated from the formula
 $RCF = 1.12 r (RPM/100)^2$
 and then rounded to three significant digits.*

Rotor Speed (rpm)	Relative Centrifugal Field (× g)			k Factor*
	At r_{max} (133.4 mm)	At r_{av} (83.9 mm)	At r_{min} (34.4 mm)	
19 000	53 900	33 900	13 900	951
17 000	43 200	27 200	11 100	1 188
15 000	33 600	21 100	8 670	1 526
12 500	23 400	14 700	6 020	2 197
10 000	14 900	9 400	3 850	3 433
7 500	8 400	5 890	2 170	6 103
5 000	3 740	2 350	963	13 732
2 500	934	587	241	54 928

* Calculated for all Beckman Coulter preparative rotors as a measure of the rotor's pelleting efficiency in water at 20°C.



NOTE

Do not use sharp tools on the rotor. Scratches in the anodized surface could lead to corrosion.

- Periodically inspect the rotor, especially inside cavities, for rough spots or pitting, white powder deposits—frequently aluminum oxide—or heavy discoloration. If any of these signs are evident, do not run the rotor. Contact your Beckman Coulter representative for information about the Field Rotor Inspection Program and the rotor repair center.
- Regularly apply silicone vacuum grease (335148) to the rotor O-ring (801773). Replace the O-ring about twice a year or whenever worn or damaged.
- Keep the threads of the rotor assembly lightly but evenly lubricated with Spinkote lubricant (306812).
- Inspect bottle assemblies, caps, O-rings, and plugs frequently, and replace if worn or damaged.

Store the rotor in a dry environment (not in the instrument) with the lid removed. Refer to Appendix A in *Rotors and Tubes* for the chemical resistances of rotor and tube materials. Your Beckman Coulter representative provides contact with the Field Rotor Inspection Program and the rotor repair center.

CLEANING

Rotor Components

Wash the rotor and rotor components immediately if salts or other corrosive materials are used or if spillage has occurred. Do not allow corrosive materials to dry on the rotor.

Under normal use conditions, wash the rotor at least weekly to prevent buildup of residues.

NOTE

Do not wash rotor components in a dishwasher.
Do not soak in detergent solution for long periods,
such as overnight.

- Wash the rotor and lid using a mild detergent, such as Beckman Solution 555™ (339555), that won't damage the rotor. The Rotor Cleaning Kit (339558) contains two brushes and two quarts of Solution 555 for use with rotors and accessories. Dilute the detergent 10 to 1 with water.

2. Rinse with distilled water.
3. Air-dry the rotor and lid upside down. *Do not use acetone to dry the rotor.*
4. Lightly but evenly lubricate the rotor drive-hole threads with Spinkote.

Clean metal threads every 6 months, or as necessary. Use a brush and concentrated Solution 555. Rinse and dry thoroughly, then lubricate lightly but evenly with Spinkote to coat all threads.

Periodically remove the lid gasket (325623) and clean it. The gasket requires no lubrication.

Bottle and Cap Assembly

1. Wash the bottle and cap parts by hand using a mild detergent, such as Solution 555, diluted 10 to 1 with water. If necessary, soak them for 10 minutes in hot distilled water or scrub lightly with a brush.
2. Rinse with distilled water.
3. Air-dry upside down.

DECONTAMINATION

If the rotor (and/or accessories) becomes contaminated with radioactive material, decontaminate it using a solution which will not damage the anodized surfaces. Beckman Coulter has tested a number of solutions and found two which do not harm anodized aluminum: RadCon Surface Spray or IsoClean Solution (for soaking),³ and Radiacwash.⁴

While Beckman Coulter has tested these methods and found that they do not damage components, no guarantee of sterility or disinfection is expressed or implied. Consult your laboratory safety officer regarding the proper decontamination methods to use.

If the rotor or other components are contaminated with toxic or pathogenic materials, follow appropriate decontamination procedures as outlined by your laboratory safety officer.

³ In U.S.A., contact Nuclear Associates (New York); in Eastern Europe and Commonwealth States, contact Victoreen GmbH (Munich); in South Pacific, contact Gammasonics Pty. Ltd. (Australia); in Japan, contact Toyo Medic Co. Ltd. (Tokyo).

⁴ In U.S.A., contact Biodex Medical Systems (Shirley, NY); internationally, contact the U.S. office to find the dealer nearest you.

STERILIZATION AND DISINFECTION

- The rotor and components can be autoclaved at 121°C for up to an hour. Place the rotor in the autoclave upside down with the lid off.
- Bottles can be autoclaved at 121°C. However, since polyallomer softens at these high temperatures, bottles should be autoclaved upside down, individually supported on a test tube rack. Do not autoclave the Delrin caps.
- Ethanol (70%)⁵ may be used on all rotor components, including those made of plastic.

While Beckman Coulter has tested these methods and found that they do not damage the rotor or components, no guarantee of sterility or disinfection is expressed or implied. When sterilization or disinfection is a concern, consult your laboratory safety officer regarding proper methods to use.

⁵ Flammability hazard. Do not use in or near an operating ultracentrifuge.

RETURNING A ROTOR

Before returning a rotor or accessory for any reason, prior permission (a Returned Goods Authorization form) must be obtained from Beckman Coulter, Inc. This RGA form may be obtained from your local Beckman Coulter office, and should contain the following information:

- serial number,
- history of use (approximate frequency of use),
- reason for the return,
- original purchase order number, billing number, and shipping number, if possible,
- name and phone number of the person to be notified upon receipt of the rotor or accessory at the factory, and
- name and phone number of the person to be notified about repair costs, etc.

To protect our personnel, it is the customer's responsibility to ensure that the parts are free from pathogens and/or radioactivity. Sterilization and decontamination must be done before returning the parts. Smaller items (such as tubes, bottles, etc.) should be enclosed in a sealed plastic bag.

*All parts must be accompanied by a note, plainly visible on the outside of the box or bag, stating that they are safe to handle and that they are not contaminated with pathogens or radioactivity. **Failure to attach this notification will result in return or disposal of the items without review of the reported problem.***

Use the address label printed on the RGA form when mailing the rotor and/or accessories to:

Beckman Coulter, Inc.
1050 Page Mill Road
Palo Alto, CA 94304

Attention: Returned Goods

Customers located outside the United States should contact their local Beckman Coulter office.

SUPPLY LIST

Contact Beckman Coulter Sales (1-800-742-2345 in the United States; worldwide offices are listed on the back cover of this manual) or see the *Beckman Coulter Ultracentrifuge Rotors, Tubes & Accessories* catalog (publication BR-8101) for detailed information on ordering parts and supplies. For your convenience, a partial list is given below.

REPLACEMENT ROTOR PARTS

Type 19 rotor assembly	325620
Rotor handle	325624
Lid gasket	325623
Rotor O-ring	801773
Overspeed disk (19 000 rpm)	330331

OTHER

Polyallomer bottle and Delrin cap assembly	334205
Polyallomer bottle only (pkg/6)	355627
Cap assembly	362247
Delrin cap	362246
Noryl plug	332836
Buna N O-ring	812715
Bottle extractor	335353
Spinkote lubricant (2 oz)	306812
Silicone vacuum grease (1 oz)	335148
Rotor Cleaning Kit	339558
Beckman Solution 555 (1 qt)	339555
Rotor cleaning brush	339379



Overspeed Disk for the Type 19 Rotor

ULTRACENTRIFUGE ROTOR WARRANTY

All Beckman Coulter ultracentrifuge Fixed Angle, Vertical Tube, Near Vertical Tube, Swinging Bucket, and Airfuge rotors are warranted against defects in materials or workmanship for the time periods indicated below, subject to the Warranty Conditions stated below.

Preparative Ultracentrifuge Rotors 5 years — No Proration

Analytical Ultracentrifuge Rotors 5 years — No Proration

ML and TL Series Ultracentrifuge Rotors 5 years — No Proration

Airfuge Ultracentrifuge Rotors 1 year — No Proration

For Zonal, Continuous Flow, Component Test, and Rock Core ultracentrifuge rotors, see separate warranty.

Warranty Conditions (as applicable)

- 1) This warranty is valid for the time periods indicated above from the date of shipment to the original Buyer by Beckman Coulter or an authorized Beckman Coulter representative.
- 2) This warranty extends only to the original Buyer and may not be assigned or extended to a third person without written consent of Beckman Coulter.
- 3) This warranty covers the Beckman Coulter Centrifuge Systems only (including but not limited to the centrifuge, rotor, and accessories) and Beckman Coulter shall not be liable for damage to or loss of the user's sample, non-Beckman Coulter tubes, adapters, or other rotor contents.
- 4) This warranty is void if the Beckman Coulter Centrifuge System is determined by Beckman Coulter to have been operated or maintained in a manner contrary to the instructions in the operator's manual(s) for the Beckman Coulter Centrifuge System components in use. This includes but is not limited to operator misuse, abuse, or negligence regarding indicated maintenance procedures, centrifuge and rotor classification requirements, proper speed reduction for the high density of certain fluids, tubes, and tube caps, speed reduction for precipitating gradient materials, and speed reduction for high-temperature operation.
- 5) Rotor bucket sets purchased concurrently with or subsequent to the purchase of a Swinging Bucket Rotor are warranted only for a term co-extensive with that of the rotor for which the bucket sets are purchased.
- 6) This warranty does not cover the failure of a Beckman Coulter rotor in a centrifuge not of Beckman Coulter manufacture, or if the rotor is used in a Beckman Coulter centrifuge that has been modified without the written permission of Beckman Coulter, or is used with carriers, buckets, belts, or other devices not of Beckman Coulter manufacture.
- 7) Rotor parts subject to wear, including but not limited to rotor O-rings, VTi, NVT™, TLV, MLN, and TLN rotor tube cavity plugs and gaskets, tubing, tools, optical overspeed disks, bearings, seals, and lubrication are excluded from this warranty and should be frequently inspected and replaced if they become worn or damaged.
- 8) Keeping a rotor log is not mandatory, but may be desirable for maintenance of good laboratory practices.

Repair and Replacement Policies

- 1) If a Beckman Coulter rotor is determined by Beckman Coulter to be defective, Beckman Coulter will repair or replace it, subject to the Warranty Conditions. A replacement rotor will be warranted for the time remaining on the original rotor's warranty.
- 2) If a Beckman Coulter centrifuge is damaged due to a failure of a rotor covered by this warranty, Beckman Coulter will supply free of charge (i) all centrifuge parts required for repair (except the drive unit, which will be replaced at the then current price less a credit determined by the total number of revolutions or years completed, provided that such a unit was manufactured or rebuilt by Beckman Coulter), and (ii) if the centrifuge is currently covered by a Beckman Coulter warranty or Full Service Agreement, all labor necessary for repair of the centrifuge.
- 3) If a Beckman Coulter rotor covered by this warranty is damaged due to a malfunction of a Beckman Coulter ultracentrifuge covered by an Ultracentrifuge System Service Agreement, Beckman Coulter will repair or replace the rotor free of charge.
- 4) If a Beckman Coulter rotor covered by this warranty is damaged due to a failure of a Beckman Coulter tube, bottle, tube cap, spacer, or adapter, covered under the Conditions of this Warranty, Beckman Coulter will repair or replace the rotor and repair the instrument as per the conditions in policy point (2) above, and the replacement policy.
- 5) Damage to a Beckman Coulter rotor or instrument due to the failure or malfunction of a non-Beckman Coulter tube, bottle, tube cap, spacer, or adapter is not covered under this warranty, although Beckman Coulter will assist in seeking compensation under the manufacturer's warranty.

Disclaimer

IT IS EXPRESSLY AGREED THAT THE ABOVE WARRANTY SHALL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND OF THE WARRANTY OF MERCHANTABILITY AND BECKMAN COULTER, INC. SHALL HAVE NO LIABILITY FOR SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER ARISING OUT OF THE MANUFACTURE, USE, SALE, HANDLING, REPAIR, MAINTENANCE, OR REPLACEMENT OF THE PRODUCT.

Factory Rotor Inspection Service

Beckman Coulter, Inc., will provide free mechanical and metallurgical inspection in Palo Alto, California, USA, of any Beckman Coulter rotor at the request of the user. (Shipping charges to Beckman Coulter are the responsibility of the user.) Rotors will be inspected in the user's laboratory if the centrifuge in which they are used is covered by an appropriate Beckman Coulter Service Agreement. Contact your local Beckman Coulter office for details of service coverage or cost.

Before shipping, contact the nearest Beckman Coulter Sales and Service office and request a Returned Goods Authorization (RGA) form and packaging instructions. Please include the complete rotor assembly, with buckets, lid, handle, tube cavity caps, etc. A SIGNED STATEMENT THAT THE ROTOR AND ACCESSORIES ARE NON-RADIOACTIVE, NON-PATHOGENIC, NON-TOXIC, AND OTHERWISE SAFE TO SHIP AND HANDLE IS REQUIRED.

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