Instruction For Use

MLS-50 Swinging Bucket Rotor

For Use in Beckman Coulter Optima MAX-XP, MAX, and MAX-E Tabletop Ultracentrifuges

PN TL-TB-023CC
October 2018

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BECKMAN COULTER

MLS-50 Swinging-Bucket Rotor
TL-TB-023CC (October 2018)

Contact Us
If you have any questions, contact our Customer Support Center.

- Worldwide, find us via our website at www.beckman.com/support/technical
- In the USA and Canada, call us at 1-800-369-0333.
- Outside of the USA and Canada, contact your local Beckman Coulter Representative.

Find us on the World Wide Web at:
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Glossary of Symbols is available at beckman.com/techdocs (PN C24689).

Original Instructions

Revision History

This document applies to the latest and higher versions. When a subsequent version changes the information in this document, a new issue will be released to the Beckman Coulter website. For updates, go to www.beckman.com/techdocs and download the latest version of the manual or system help for your instrument.

Issue CC, 10/2018

Changes or additions were made to:

- Certified Free Tubes
- Sterile Tubes
- Table 1, Available Tubes and Bottles for the Type 50.2 Ti Rotor. Use only the items listed here and observe fill volumes and maximum run speeds.
- Sterilization and Disinfection

Note: *Changes that are part of the most recent revision are indicated in text by a bar in the margin of the amended page.*

Safety Notice

Read all product manuals and consult with Beckman Coulter-trained personnel before attempting to use this equipment. Do not attempt to perform any procedure before carefully reading all instructions. Always follow product labeling and manufacturer's recommendations. If in doubt as to how to proceed in any situation, contact your Beckman Coulter Representative.

Alerts for Warning, Caution, and Note

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTE NOTE is used to call attention to notable information that should be followed during installation, use, or servicing of this equipment.

Safety Information for the MLS-50 Rotor

Handle body fluids with care because they can transmit disease. No known test offers complete assurance that such fluids are free of micro-organisms. Some of the most virulent—Hepatitis (B and C) viruses, HIV (I–V), atypical mycobacteria, and certain systemic fungi—further emphasize the need for aerosol protection. Handle other infectious samples according to good laboratory procedures and methods to prevent spread of disease. Because spills may generate aerosols, observe proper safety precautions for aerosol containment. Do not run toxic, pathogenic, or radioactive materials in this rotor without taking appropriate safety precautions. Biosafe containment should be used when Risk Group II materials (as identified in the World Health Organization *Laboratory Biosafety Manual*) are handled; materials of a higher group require more than one level of protection.

The rotor and accessories are not designed for use with materials capable of developing flammable or explosive vapors. Do not centrifuge such materials in nor handle or store them near the ultracentrifuge.

Although rotor components and accessories made by other manufacturers may fit in the MLS-50 rotor, their safety in this rotor cannot be ascertained by Beckman Coulter. Use of other manufacturers' components or accessories in the MLS-50 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.

Hook all four buckets, loaded or empty, to the rotor for every run. Make sure that filled containers are loaded symmetrically into the rotor and that opposing tubes are filled to the same level with liquid of the same density. Make sure that buckets containing Quick-Seal tubes have the proper floating spacers inserted (if applicable) before installing the bucket cap.

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

Never exceed the maximum rated speed of the rotor and labware in use. Refer to the section on *Run Speeds*, and derate the run speed as appropriate.

Do not use sharp tools on the rotor that could cause scratches in the rotor surface. Corrosion begins in scratches and may open fissures in the rotor with continued use.

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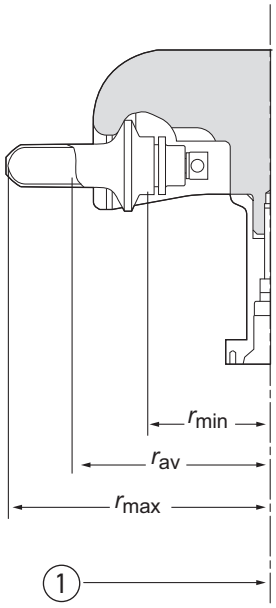
MLS-50 Swinging Bucket Rotor

Specifications

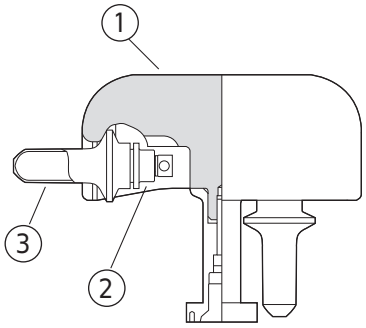


1. Axis of Rotation

Maximum speed	50,000 RPM
Density rating at maximum speed	1.2 g/mL
Relative Centrifugal Field[a] at maximum speed	
At r_{max} (95.8 mm)	268,000 × *g*
At r_{av} (71.7 mm)	201,000 × *g*
At r_{min} (47.5 mm)	133,000 × *g*
k factor at maximum speed	71
k factors at maximum speed (5 to 20% sucrose gradient; 5°C)	
When particle density = 1.3 g/mL	195
When particle density = 1.5 g/mL	178
When particle density = 1.7 g/mL	172
Conditions requiring speed reductions	see *Run Speeds*
Number of buckets	4
Available tubes	see Table 1
Nominal tube dimensions (largest tube)	13 × 51 mm
Nominal tube capacity (largest tube)	5 mL
Nominal rotor capacity	20 mL
Approximate acceleration time to maximum speed (fully loaded)	7½ min
Approximate deceleration time from maximum speed (fully loaded)	4½ min
Weight of fully loaded rotor	1.69 kg (3.73 lb)
Rotor bucket material	titanium
Rotor body material	aluminum

a. 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: RCF = $r\omega^2/g$ — where r is the radius in millimeters, ω is the angular velocity in radians per second (2 π RPM /60), and g is the standard acceleration of gravity (9807 mm/s^2). After substitution: RCF = 1.12r (RPM/1000)^2

Description



1. Rotor Body
2. Bucket Cap Assembly (367285)
3. Bucket (367284)

The Beckman Coulter MLS-50 rotors are manufactured in a facility that maintains certifications to both ISO 9001:2008 and ISO 13485:2003. They are for use in the specified Beckman Coulter ultracentrifuges.

The MLS-50, rated for 50,000 RPM, is a swinging-bucket rotor that holds four tubes and is used in Beckman Coulter Optima MAX-XP, MAX, and MAX-E tabletop ultracentrifuges. The MLS-50 rotor develops centrifugal forces that are suitable for rate zonal banding of proteins, viruses, and DNA from small sample volumes.

The rotor body and bucket caps are made of aluminum and are anodized for corrosion resistance. The buckets are titanium. Lubricated O-rings made of Buna N maintain atmospheric pressure inside the buckets during centrifugation. Buckets, bucket caps, and rotor body positions are numbered for your convenience. A rotor-retention mechanism on the ultracentrifuge drive hub secures the rotor during the run. When not in the instrument, the rotor body must be supported on its rotor stand to permit the buckets to hang properly.

The centrifuge identifies rotor speed during the run by means of a magnetic speed sensor system in the rotor chamber of the instrument and magnets on the bottom of the rotor. This overspeed protection system ensures that the rotor does not exceed its permitted speed.

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

Preparation and Use

Specific information about the MLS-50 rotor is given here. Information common to this and other rotors is contained in the manual *Rotors and Tubes for Beckman Coulter Tabletop Preparative Ultracentrifuges* (publication TLR-IM-9), which should be used together with this manual for complete rotor and accessory operation. *Rotors and Tubes* is included in the literature package with this rotor manual.

NOTE Although rotor components and accessories made by other manufacturers may fit in the MLS-50 rotor, their safety in this rotor cannot be ascertained by Beckman Coulter. Use of other manufacturers' components or accessories in the MLS-50 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.

Prerun Safety Checks

Read the Safety Notice section at the front of this manual before using the rotor.

1 Make sure that the rotor, buckets, and caps are clean and show no signs of corrosion or cracking.

2 Verify that the tubes and accessories being used are listed in Table 1.

3 Check the chemical compatibilities of all materials used.

Refer to *Chemical Resistances* (publication IN-175), included in the *Rotors and Tubes* CD.

Rotor Preparation

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

1 Before each use of the rotor, make sure that bucket cap threads are lightly but evenly lubricated with Spinkote lubricant (306812), and the bucket O-rings are lightly but evenly coated with silicone vacuum grease (335148).

NOTE Never run a bucket without an O-ring, as it will leak.

2 Dry the exterior of the filled tubes (see page 8 for tube information), then slide them into the buckets.

(Moisture between the bucket and the tube can cause tube collapse and create resistance to tube extraction after centrifugation.)

All opposing tubes for a run must be filled to the same level with liquid of the same density.

3 Use the required adapters or floating spacers, if required, to complete the loading operation.

4 Match numbered caps with numbered buckets.

Screw the caps into the buckets until there is metal-to-metal contact.

Ensure that the scribe mark on each cap is aligned with the engraved bucket number.

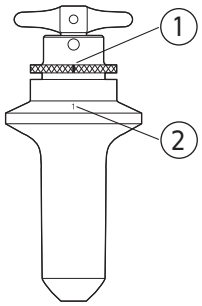
NOTE Two tubes can be run if the filled buckets are attached in opposing positions on the rotor (positions 1 and 3, or 2 and 4), *and the two remaining buckets are also attached*. (If you regularly run only two filled buckets, alternate the placement—positions 1 and 3, then 2 and 4—to ensure even wear on the rotor.)

5 Attach numbered bucket assemblies to corresponding rotor body positions.

Insert the bucket assembly into the rotor cavity.

Attach all buckets, loaded or empty.

NOTE Remember, all four buckets *must be attached to the rotor*, whether they are loaded or empty. Attach the buckets to the rotor before installing it in the instrument. Trying to attach them after the rotor is installed may cause damage to the drive shaft.

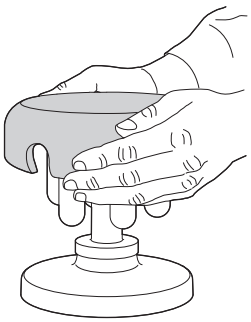


1. Scribe Mark
2. Bucket Number

Operation

Refer to *Rotors and Tubes for Beckman Coulter Tabletop Preparative Ultracentrifuges* (publication TLR-IM-9) for information on installing swinging bucket rotors.

1 To install the rotor, carefully lift it with both hands and place it on the drive hub.



2 Refer to the instrument instruction manual for ultracentrifuge operation.

3 For additional operating information, see the following:

- *Run Times*, page 10, for using *k* factors to adjust run durations.
- *Run Speeds*, page 10, for information about speed limitations.
- *Selecting CsCl Gradients*, page 14, for methods to avoid CsCl precipitation during centrifugation.

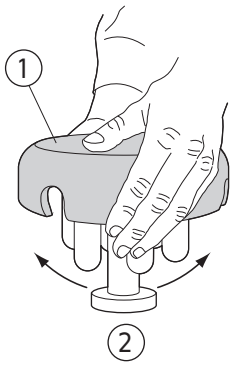
Removal and Sample Recovery

⚠ CAUTION

Risk of contamination. 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 Using both hands, remove the rotor from the ultracentrifuge.

(If necessary, hold the rotor top rigid while flexing the adapter gently back and forth to release it from the drive hub.)

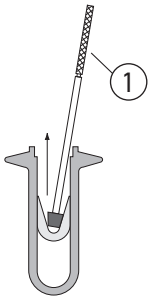


1. Hold the top in place
2. Flex the adapter

2 Return the rotor to its stand and detach the buckets from the rotor body.

3 Unscrew the bucket caps, then use a hemostat or tube removal tool to remove the tubes.

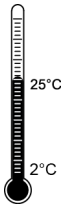
NOTE If the conical-shaped adapters that support *k*onical tubes are difficult to remove after centrifugation, an extractor tool (354468) is available to facilitate removal.



1. Extractor Tool (354468)
   While pressing the rubber tip against the adapter wall, pull the tube and adapter up and out of the cavity.

Tubes and Accessories

The MLS-50 rotor uses tubes and accessories listed in Table 1. Be sure to use only those items listed, and to observe the maximum speed limits shown. Refer to *Chemical Resistances* (IN-175) for information on the chemical compatibilities of tube and accessory materials.



Temperature Limits

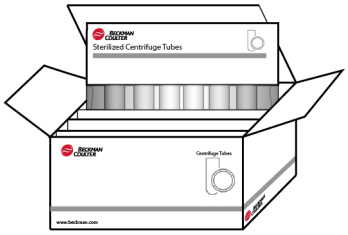
- Plastic tubes have been centrifuge tested for use at temperatures between 2 and 25°C. For centrifugation at other temperatures, pretest tubes under anticipated run conditions.
- If plastic containers are frozen before use, make sure that they are thawed to at least 2°C prior to centrifugation.

Certified Free Tubes

Based on Sample Results Below Detectable Limit

Certified free tubes are lot traceable to testing that confirms the absence of endotoxin, DNase, RNase, and human & mouse DNA below a detectable limit.

Sterile Tubes



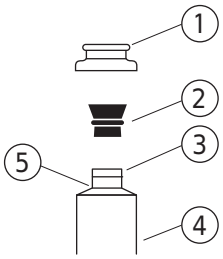
Sterile tubes are sterilized via ethylene oxide in compliance with ISO 11135:2014. Cartons include several peel packages, each containing a typical run quantity of tubes per the tube details in Table 1. Packaging meets requirements of ISO11607:2006.

OptiSeal Tubes

OptiSeal tubes come with plastic plugs and can be quickly and easily prepared for use. With the tube spacer in place, the *g* force during centrifugation ensures a tight, reliable seal that protects your samples.

1 Place the tubes in the rack and fill each tube to the base of the stem, leaving no fluid in the stem.

Overfilling the tube can cause spillage when the plug is inserted or compromise seal integrity. However, too much air can cause excessive tube deformation, disrupting gradients and sample bands.



1. Spacer
2. Plug
3. Stem
4. Tube
5. Base of Stem

2 Refer to *Using OptiSeal Tubes* (publication IN-189), included in each box of tubes, for detailed information on the use and care of OptiSeal tubes.

Table 1 Beckman Coulter Tubes and Bottles for the SMLS-50 Rotor[a]

Tube			Required Accessory		
Dimensions and Max Volume/	**Description**	**Part Number**	**Description**	**Part Number**	**Max Speed /RCF/*k* factor**
13 × 51 mm 5.0 mL	Certified Free & Sterile Ultra-Clear Open-Top	C14295 Carton of 48 (8 packs of 6)	none	—	50,000 RPM 268,000 × *g* 71
	Certified Free Ultra-Clear Open-Top	C14279 (pkg/50)			
	Standard Ultra-Clear Open-Top	344057 (pkg/50)			
13 × 51 mm 5.0 mL	thinwall polypropylene	326819 (pkg/50)	none	—	50,000 RPM 268,000 × *g* 71
13 × 51 mm 3.5 mL	thickwall polypropylene	349623 (pkg/25)	none	—	50,000 RPM 268,000 × *g* 71
13 × 51 mm 3.5 mL	thickwall polycarbonate	349622 (pkg/25)	none	—	50,000 RPM 268,000 × *g* 71
13 × 51 mm 3.2 mL	Quick-Seal polypropylene *k*onical	358647 (pkg/250)	Acetal (POM) adapter	358153 (pkg/6)	50,000 RPM 262,000 × *g* 67
			Polyphenylene oxide (PPO) floating spacer	355535	
13 × 51 mm 3.0 mL	thinwall polypropylene *k*onical	359119 (pkg/50)	Acetal (POM) adapter	338153 (pkg/6)	50,000 RPM 262,000 × *g* 67
13 × 25 mm 2.0 mL	Quick-Seal polypropylene	345829 (pkg/50)	Polyphenylene oxide (PPO) floating spacer	355535	50,000 RPM 268,000 × *g* 29

a. Use only the items listed here..

Quick Seal Tubes

Quick-Seal tubes must be sealed prior to centrifugation. These tubes are heat sealed and do not need caps; however, spacers are required on top of the tubes when they are loaded into the rotor buckets.

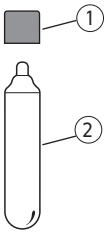
1 Fill Quick-Seal tubes leaving a *small* bubble of air at the base of the neck.

Do not leave a large air space—too much air can cause excessive tube deformation.

2 Some of the Quick-Seal tubes listed in Table 1 are part of the *g*-Max system, which uses a combination of small bell-top Quick-Seal tubes and floating spacers (also called *g*-Max spacers).

This means that you can run the shorter tubes listed in Table 1 in the MLS-50 rotor without reduction in *g* force.

For detailed information on the *g*-Max system see publication DS-709B.



1. *g*-Max Spacer
2. Bell-top Tube

3 Refer to *Rotors and Tubes for Beckman Coulter Tabletop Preparative Ultracentrifuges* (publication TLR-IM-9) for detailed information on the use and care of Quick-Seal tubes.

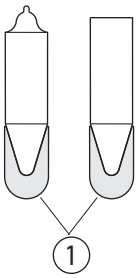
Quick-Seal tubes are disposable and should be discarded after a single use.

Open-Top Tubes

Open-top tubes should be filled to approximately 3.17 mm (0.125 in.) from the tube top for tube support. If necessary, float mineral oil (or some other low-density, immiscible liquid) on top of the tube contents to fill the tube to its maximum volume. (Do not use an oil overlay in Ultra-Clear tubes.

*k*onical Tubes

Polypropylene konical tubes, used to optimize pelleting separations, have a conical tip that concentrates the pellet in the narrow end of the tube. The narrow bottom also reduces the tube's nominal volume and minimizes gradient material requirement. The konical tubes come in both open-top and Quick-Seal tube designs. Conical cavity adapters hold the tubes in the rotor buckets.



1. Adapters

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

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

where ω is the angular velocity of the rotor in radians per second (ω = 0.105 × RPM), r_{max} is the maximum radius, and r_{min} is the minimum radius.

After substitution:

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

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*).

$$t = \frac{k}{s} \quad \text{EQ 3}$$

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

$$k_{adj} = k\left(\frac{50,000}{\text{actual run speed}}\right)^2 \quad \text{EQ 4}$$

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:

$$\frac{t_a}{t_b} = \frac{k_a}{k_b} \quad \text{EQ 5}$$

Run Speeds

The centrifugal force at a given radius in a rotor is a function of 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 Table 2.

Do not select rotational speeds in excess of 50,000 RPM. In addition, speeds must be reduced under the following circumstances:

1. 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:

$$\text{reduced maximum speed} = (50,000\ \text{RPM})\sqrt{\frac{1.2\ \text{g/mL}}{\rho}} \quad \text{EQ 6}$$

where ρ is he density of the tube contents. This speed reduction will protect the rotor from excessive stresses due to the added tube load.

2. *Further speed limits must be imposed* when CsCl or other self-forming-gradient salts are centrifuged, as equation (6) does not predict concentration limits/speeds that are required to avoid precipitation of salt crystals. Solid CsCl has a density of 4 g/mL, and if precipitated during centrifugation may cause rotor failure. Figure 1 and Figure 2, together with the description and examples below, show how to reduce run speeds when using CsCl gradients.

Table 2 Relative Centrifugal Fields for the MLS-50 Rotor[a]

Rotor Speed (RPM)	Relative Centrifugal Field (× *g*)			*k* Factor[b]
	At r_{max} (95.8 mm)	At r_{av} (71.7 mm)	At r_{min} (47.5 mm)	
50,000	268,000	201,000	133,000	71
45,000	217,000	163,000	108,000	88
40,000	172,000	129,000	85,100	111
35,000	131,000	98,400	65,200	145
30,000	96,600	72,300	47,900	197
25,000	67,100	50,200	33,300	284
20,000	42,900	32,100	21,300	444
15,000	24,100	18,100	12,000	790
10,000	10,700	8,030	5,320	1777

a. Entries in this table are calculated from the formula RCF = 1.12*r* (RPM/1000)^2 and then rounded to three significant digits.

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

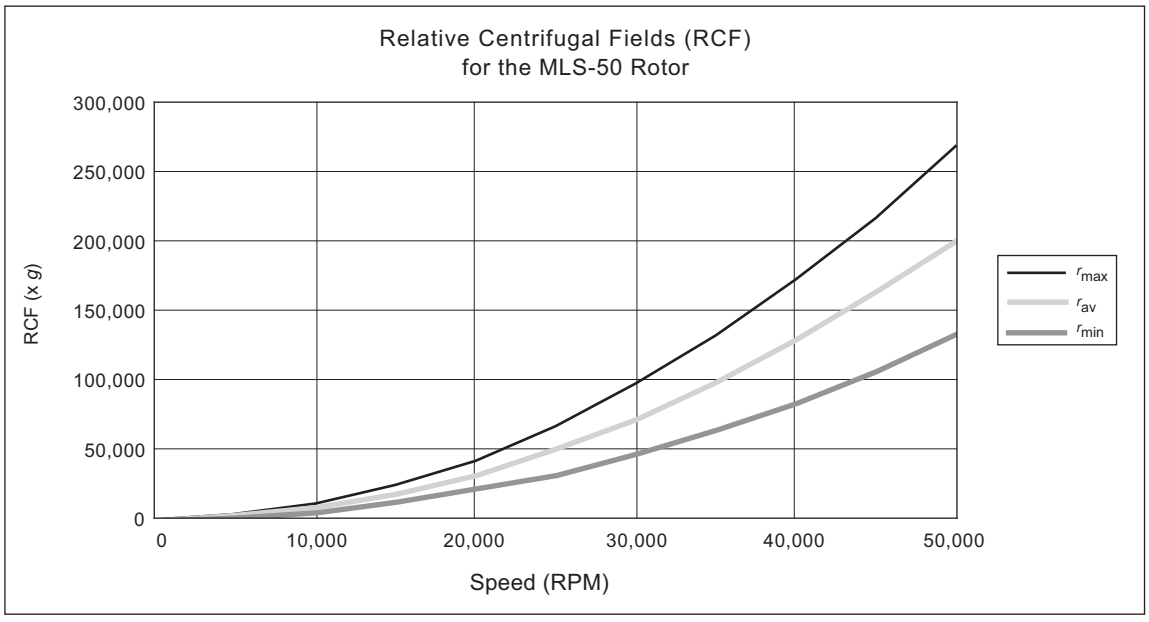
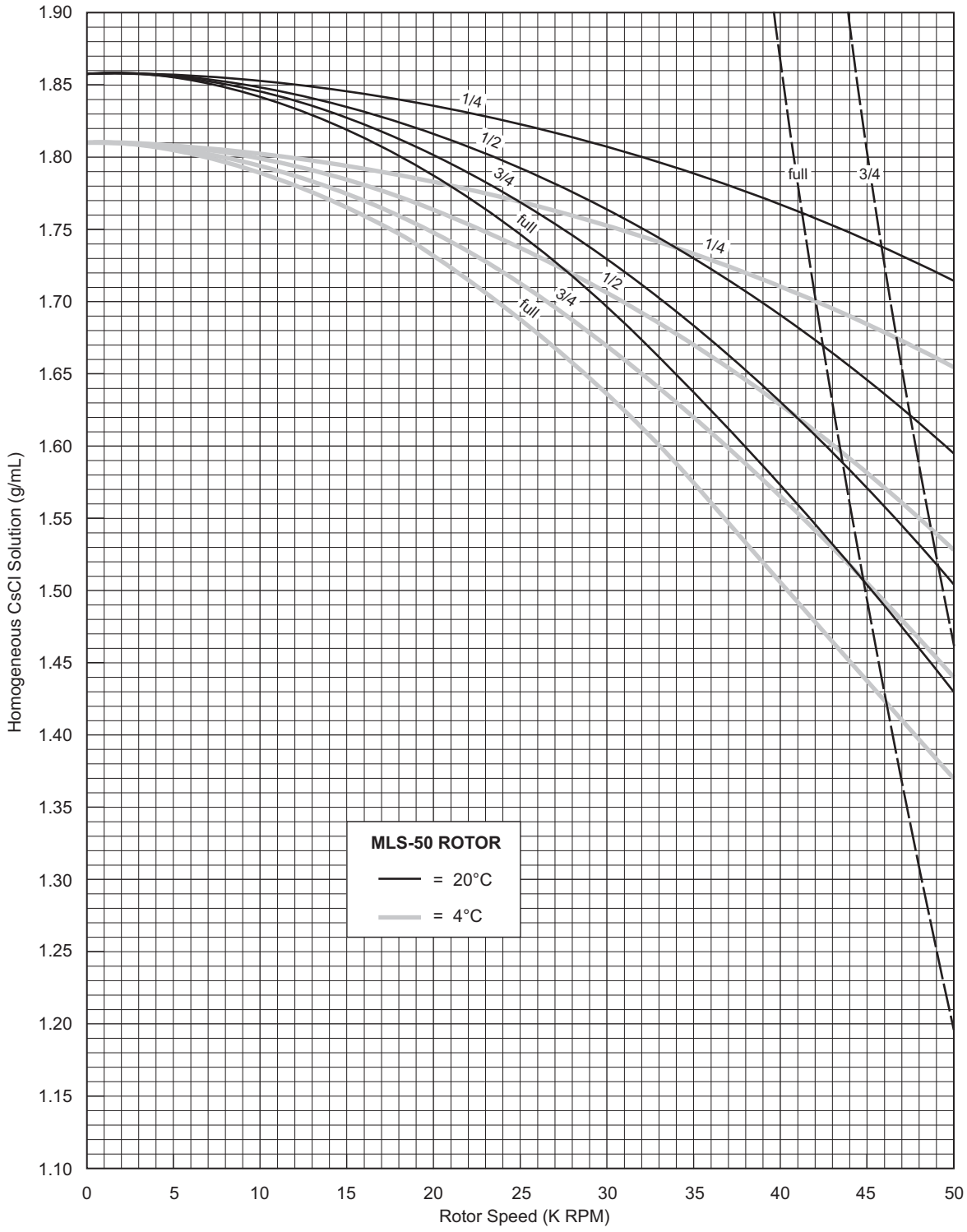
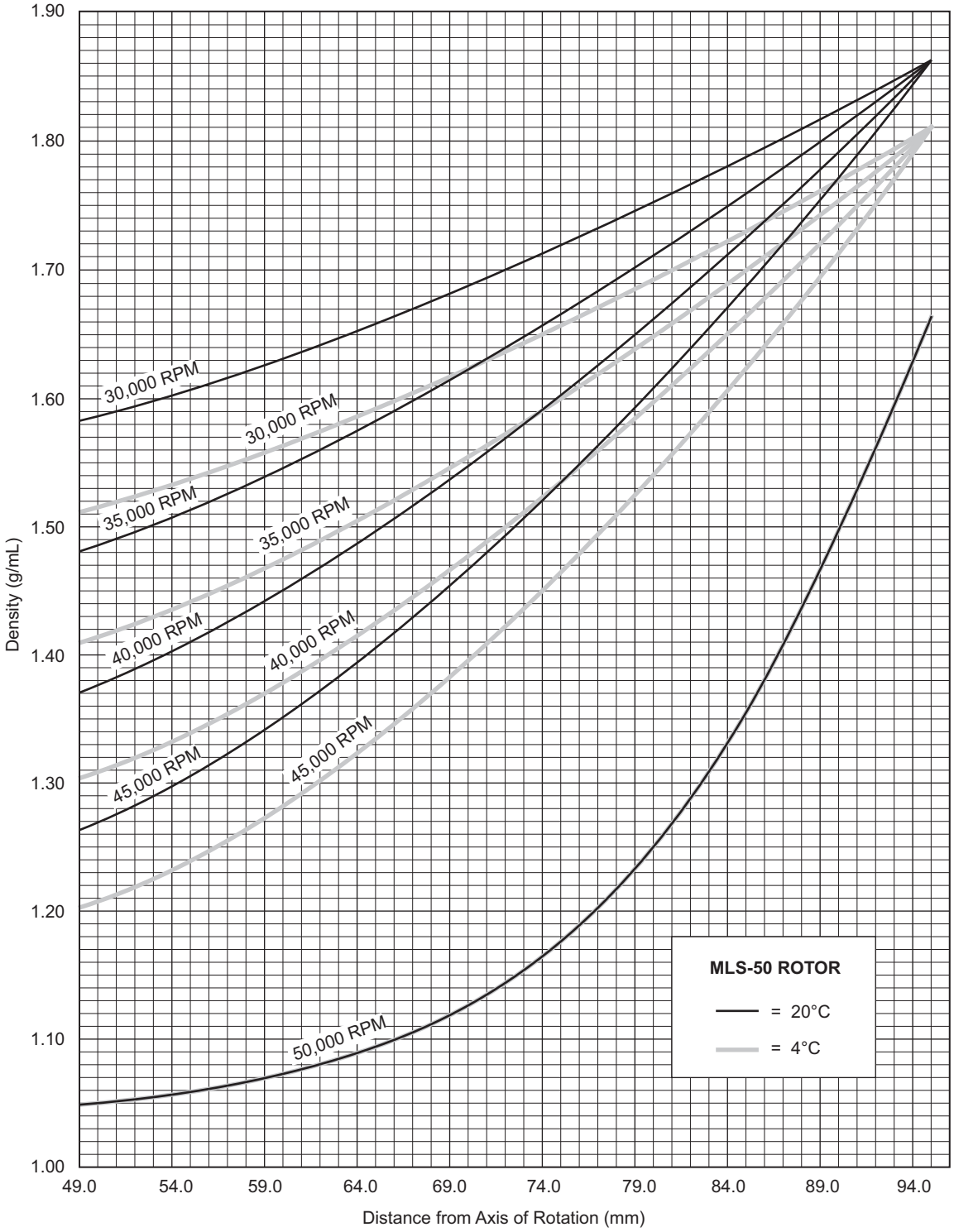


Figure 1 Precipitation Curves for the MLS-50 Rotor*



* Using combinations of rotor speeds and homogeneous CsCl solution densities that intersect on or below these curves ensures that CsCl will not precipitate during centrifugation. The dashed lines are representations of EQ 6, and are shown here to illustrate the inability of that equation to predict CsCl precipitation.

Figure 2 CsCl Gradients at Equilibrium for the MLS-50 Rotor*



* Centrifugation of homogeneous CsCl solutions at the maximum allowable speeds (from Figure 1) results in gradients presented here. Note that the 50,000 RPM curves are the same for 4 and 20°C.

Selecting CsCl Gradients

Rotor speed is used to control the slope of a CsCl density gradient, and must be limited so that CsCl precipitation is avoided. Speed and density combinations that intersect on or below the curves in Figure 1 ensure that CsCl will not precipitate during centrifugation in the MLS-50 rotor. Curves are provided at two temperatures: 20°C (black curves) and 4°C (gray curves). Curves in Figure 1 and Figure 2 are provided up to the maximum rated speed of the rotor.

NOTE The curves in Figure 1 and Figure 2 are for solutions of CsCl salt dissolved in distilled water only. If other salts are present in significant concentrations, the overall CsCl concentration may need to be reduced.

The reference curves in Figure 2 show gradient distribution at equilibrium. Each curve in Figure 2 is within the density limits allowed for the MLS-50 rotor: each curve was generated for a single run speed using the maximum allowable homogeneous CsCl densities that avoid precipitation at that speed. (The gradients in Figure 2 can be generated from step or linear gradients, or from homogeneous solutions. But the total amount of CsCl in solution must be equivalent to a homogeneous solution corresponding to the concentrations specified in Figure 1.) Figure 2 can also be used to approximate the banding positions of sample particles. Curves not shown in the figure may be interpolated.

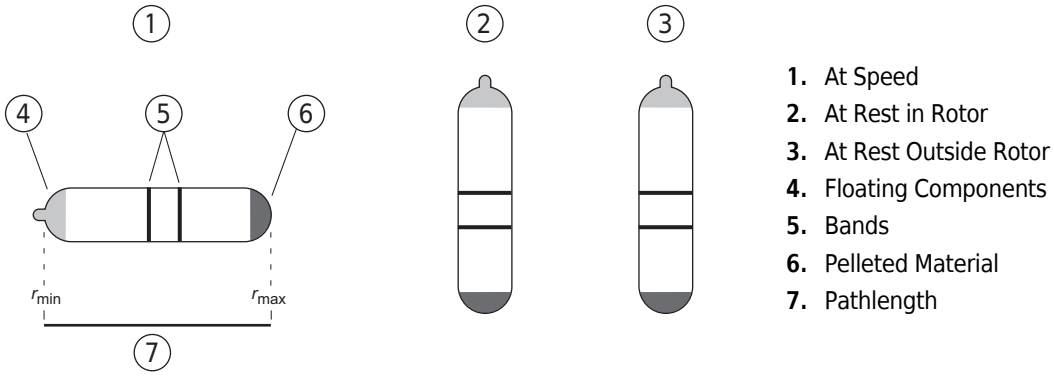
Adjusting Fill Volumes

Figure 1 and Figure 2 show that several fill volumes are possible in a tube. If a thinwall tube is partially filled with gradient solution, float mineral oil (or some other low-density, immiscible liquid) on top of the tube contents to fill the tube to its maximum volume. (Do not use an oil overlay in Ultra-Clear tubes.) Note that for a given CsCl density, as the fill level decreases the maximum allowable speed increases. Partial filling may be desirable when there is little sample or when you wish to shorten the run time.

For example, a *half-filled* tube of 1.62-g/mL homogeneous CsCl solution at 4°C may be centrifuged at 41,000 RPM (see Figure 1). The same solution in a *three-quarter-filled* tube may be centrifuged no faster than 35,000 RPM. A tube *full* of the 1.62-g/mL CsCl solution may be centrifuged no faster than 31,000 RPM (curves not shown in the figure may be interpolated).

Typical Examples for Determining CsCl Run Parameters

Example A:
Starting with a homogeneous CsCl solution density of 1.62 g/mL and approximate particle buoyant densities of 1.59 and 1.61 g/mL, at 20°C, where will particles band at equilibrium?



1 In Figure 1 find the curve that corresponds to the desired run temperature (20°C) and fill volume (full).

The maximum allowable rotor speed is determined from the point where this curve intersects the homogeneous CsCl density (36,000 RPM).

2 In Figure 2, sketch in a horizontal line corresponding to each particle's buoyant density.

3 Mark the point in the figure where each particle density intersects the curve corresponding to the selected run speed and temperature.

Particles will band at these locations across the tube diameter at equilibrium during centrifugation.

In this example, particles will band about 67.0 and 70 mm from the tube bottom (r_{max}), about 3 mm of centerband-to-centerband separation.

To determine interband volume in milliliters, use the following equation:

$$V = \pi r^2 h \qquad \text{EQ 7}$$

where r is the tube radius in centimeters and h is the interband separation in centimeters

Example B:
Knowing particle buoyant densities (for example, 1.49 and 1.52 g/mL), how do you achieve good separation?

1. In Figure 2, sketch in a horizontal line corresponding to each particle's buoyant density.
2. Select the curve at the required temperature (4°C) that gives the best particle separation.
3. Note the run speed along the selected curve (35,000 RPM).
4. From Figure 1, select the maximum homogeneous CsCl density that corresponds to the temperature and run speed established above.

   These parameters will provide the particle-banding pattern selected in Step 2.

In this example, particles will band at about 62 and 66 mm from the tube bottom (about 4 mm apart).

Care and Maintenance

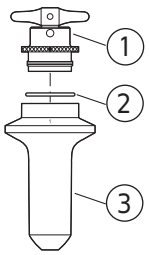
Maintenance

NOTE Do not use sharp tools on the rotor that could cause scratches in the rotor surface. Corrosion begins in scratches and may open fissures in the rotor with continued use.

1. Frequently check the bucket O-rings (824412) for signs of wear.

   Replace O-rings every 6 months, or whenever worn or damaged.

   Keep the O-rings lightly coated with silicone vacuum grease (335148).



1. Cap
2. O-ring (824412)
3. Bucket

2. Regularly lubricate the bucket cap threads with a thin, even coat of Spinkote lubricant (306812) before every run.

3 Regularly lubricate the bucket cap threads with a thin, even coat of Spinkote lubricant before every run.

4 Refer to *Chemical Resistances* (IN-175) for the chemical compatibilities of rotor and accessory materials.

Your Beckman Coulter representative provides contact with the Field Rotor Inspection Program and the rotor repair center.

Cleaning

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, wash the rotor frequently (at least weekly) to prevent buildup of residues.

1 Wash the rotor buckets, O-rings, and caps in a mild detergent, such as Solution 555, that won't damage the rotor.

Dilute the detergent with water (10 parts water to 1 part detergent.)

The Rotor Cleaning Kit contains two plastic-coated brushes and two quarts of Solution 555 (339555) for use with rotors and accessories.

2 Wash the rotor body with a sponge or cloth dampened with a mild detergent, such as Solution 555, diluted with water (10 parts water to 1 part detergent).

NOTE Do not immerse the rotor body or bucket cap in water.

3 Rinse the cleaned rotor and components with distilled water.

4 Air-dry the rotor and lid upside down.

Do not use acetone to dry the rotor.

5 Clean metal threads frequently to prevent buildup of residues and ensure adequate closure.

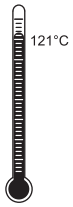
a. Use a brush and concentrated Solution 555.

b. Rinse and dry thoroughly, then lubricate lightly but evenly with Spinkote to coat all threads.

Decontamination

If the rotor or other components are contaminated with toxic, radioactive, or pathogenic materials, follow appropriate decontamination procedures as outlined by your laboratory safety officer. Refer to *Chemical Resistances* (IN-175) to select solutions that will not damage the rotor and accessory materials.

Sterilization and Disinfection



- The rotor and all rotor components, except those made of polyphenylene oxide (PPO), can be autoclaved at 121°C for up to an hour. Remove the plugs from the rotor and place the rotor, plugs, and spacers in the autoclave upside down.
- Ethanol (70%) or hydrogen peroxide (6%) may be used on all rotor components, including those made of plastic. Bleach (sodium hypochlorite) may be used, but may cause discoloration of anodized surfaces. Use the minimum immersion time for each solution, per laboratory standards.

⚠ CAUTION

Risk of personal injury or equipment damage. Ethanol is a flammability hazard. Do not use it in or near operating ultracentrifuges.

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.

Where sterilization is critical in your application, consider using Beckman Coulter Certified Free & Sterilized Tubes. For tubes not available in the sterilized option, refer to *Use and Care of Centrifuge Tubes and Bottles* (publication IN-192) included in each box of tubes or bottles for sterilization and disinfection procedures. *Quick-Seal, Ultra Clear, and thinwall open-top tubes are disposable and should be discarded after a single use.*

Storage

When it is not in use, store the rotor in a dry environment (not in the instrument) with the bucket caps removed to allow air circulation so moisture will not collect in the tube cavities.

Returning a Rotor

Before returning a rotor or accessory for any reason, prior permission must be obtained from Beckman Coulter, Inc. An authorization form may be obtained from your local Beckman Coulter sales office. The form, entitled *Returned Material Authorization* (RMA) for United States returns or *Returned Goods Authorization* (RGA) for international returns, should contain the following information:

- rotor type and 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 email address of the person to be notified upon receipt of the rotor or accessory at the factory,
- name and email address of the person to be notified about repair costs, etc.

To protect our personnel, it is the customer's responsibility to ensure that all 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 RMA/RGA form when mailing the rotor and/or accessories.

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

Supply List

See the Beckman Coulter *Ultracentrifuge Rotors, Tubes & Accessories* catalog (BR-8101) available at www.beckman.com, or contact your local Beckman Coulter Representative for detailed information on ordering parts and supplies (customers in the U.S.A or Canada can call Beckman Coulter Customer Service at 1-800-742-2345). For your convenience, a partial list is given below.

Replacement Rotor Parts

Description	Part Number
MLS-50 rotor assembly	367279
Buckets (set of 4, with cap assemblies)	367284
Bucket cap assembly	367285
Bucket O-ring	824412
Rotor stand	367278

Other

NOTE For MSDS information, go to the Beckman Coulter website at www.beckman.com.

Description	Part Number
Tubes and accessories	see Table 1
Bucket rack	331313
OptiSeal tube rack	360534
Quick-Seal Cordless Tube Topper kit, 60 Hz	358312
Quick-Seal Cordless Tube Topper kit, 50 Hz (Europe)	358313
Quick-Seal Cordless Tube Topper kit, 50 Hz (Great Britain)	358314
Quick-Seal Cordless Tube Topper kit, 50 Hz (Australia)	358315
Quick-Seal Cordless Tube Topper kit, 50 Hz (Canada)	367803
Tube Topper rack (13-mm dia. tubes)	348122
Floating spacer removal tool	338765
Tube removal tool (Quick-Seal and OptiSeal tubes)	361668
Extractor tool (*k*onical tube adapters)	354468
Fraction Recovery System (for TL-series tubes)	347828
CentriTube Slicer	347960
CentriTube Slicer blades (pkg of 10)	348299
Spinkote lubricant (2 oz)	306812
Silicone vacuum grease (1 oz)	335148
Rotor Cleaning Kit	339558
Solution 555 (1 qt)	339555
Rotor cleaning brush	339379

Beckman Coulter, Inc.
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. Maintain one copy of this software for backup purposes (the backup copy shall be supplied by 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.

Beckman Coulter will assist in seeking compensation under the manufacturer's warranty.

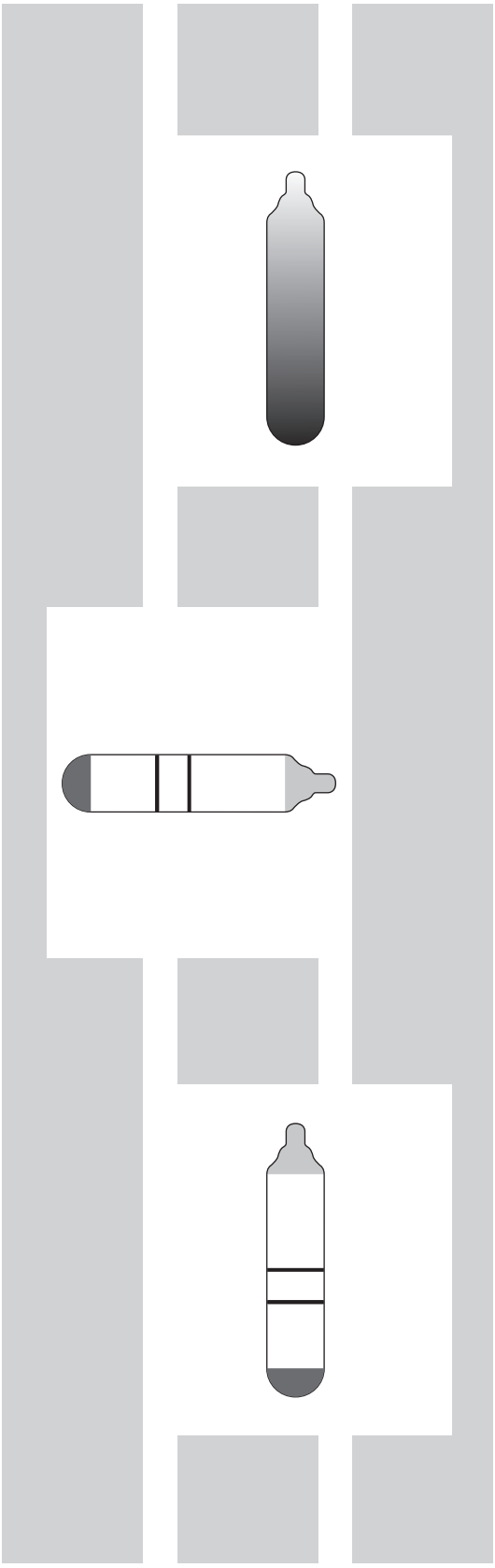
Disclaimer

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 Indianapolis, Indiana, 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.



Related Documents

Rotors and Tubes for Tabletop Preparative Ultracentrifuges (TLR-IM-9)

- Rotors
- Tubes and Accessories
- Using Tubes and Accessories
- Using Rotors
- Care and Maintenance
- Chemical Resistances for Beckman Coulter Centrifugation Products
- The Use of Cesium Chloride Curves
- Gradient Materials
- References
- Glossary

Available in electronic pdf by request.

Rotors and Tubes CD-ROM (369668)

- Rotors and Tubes for Tabletop Preparative Ultracentrifuges
- Rotors and Tubes for J2, J6, Avanti J Series Centrifuges
- Rotors and Tubes for Preparative Ultracentrifuges
- Rotor Safety Bulletin
- Chemical Resistances for Beckman Coulter Centrifugation Products

Included with shipment of instrument.

Additional References

- Chemical Resistances for Beckman Coulter Centrifugation Products (IN-175)
- Beckman Coulter Ultracentrifuge Rotors, Tubes & Accessories catalog (BR-8101)
- Using OptiSeal Tubes (IN-189)
- Use and Care of Centrifuge Tubes and Bottles (IN-192)

Available in hard copy or electronic pdf by request.

Data Sheets

- *g*-Max System: Short Pathlengths in High Force Fields (DS-709B)

Available at www.beckman.com.

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