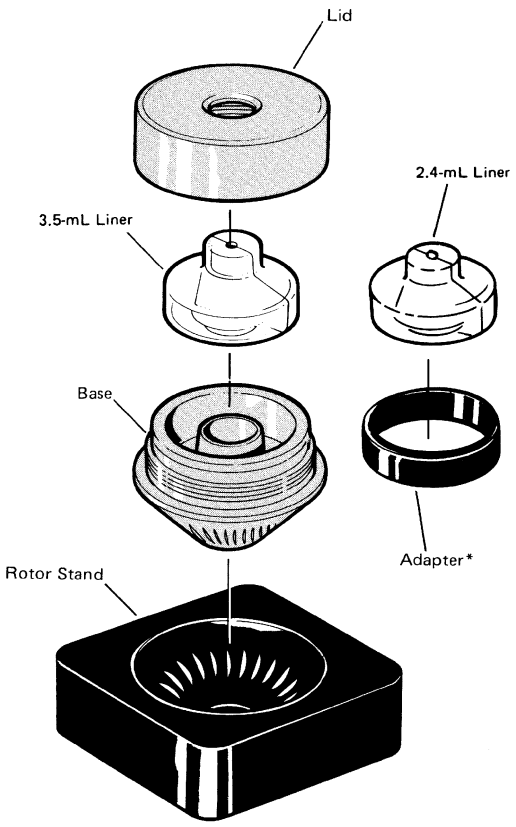
INSTRUCTIONS FOR USING THE ACR-90 ROTOR

In the Beckman Coulter Airfuge® Ultracentrifuge



*Used with 2.4-mL liner only.

U.S. Pat. Nos. 3,096,283; 4,142,670; 4,177,921; 4,120,927
British Pat. Nos. 2,013,110; 2,004,777; 1,574,158
Swiss Pat. No. 627,377
Japanese U.M. No. 1,457,490
French Pat. Nos. 78 27 823; 79 02 036
German Pat. No. 2720803
Canadian Pat. No. 1,090,073

SPECIFICATIONS

	2.4-mL Liner	3.5-mL Liner
Maximum speed (±5000 rpm)	90 000 rpm	90 000 rpm
Air pressure at ultracentrifuge required for maximum speed	210 kPa (30 psig)	210 kPa (30 psig)
Relative Centrifugal Field* at maximum speed		
At r_{max}	(11.8 mm) 107 000 × g	(13.4 mm) 122 000 × g
At r_{av}	(7.4 mm) 67 000 × g	(8.3 mm) 75 000 × g
At r_{min}	(3.0 mm) 27 000 × g	(3.0 mm) 27 000 × g
k factor at maximum speed	39	45
Liner volume		
Total	2.4 mL	3.5 mL
Inner chamber	1.0 mL	0.9 mL
Outer chamber	1.4 mL	2.6 mL
Approximate acceleration time to maximum speed	1/2 to 1 min	1/2 to 1 min
Approximate deceleration time from maximum speed	2 1/2 to 5 1/2 min	2 1/2 to 5 1/2 min
Weight of fully loaded rotor	50 grams	50 grams
Rotor material	aluminum	aluminum
Lid material	stainless steel	stainless steel

* 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:

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

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

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

DESCRIPTION

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

The ACR-90 rotor is rated for 90 000 rpm at 210 kPa (30 psig). The rotor, used with the Beckman Coulter Airfuge® Ultracentrifuge,[1] can generate centrifugal forces to clarify lipemic serum by flotation of the chylomicrons after 10 minutes of centrifugation.

The rotor base is made of aluminum and is anodized for corrosion resistance. Turbine flutes on the rotor base allow it to be lifted and turned by jets of air. A white plastic bushing is fitted in the rotor bottom to aid rotor deceleration. The rotor stand supports the rotor during loading and unloading, and while the stainless steel lid is being secured.

The sample is carried in disposable polyethylene liners that fit into the cavity of the rotor base. A Delrin[2] adapter is required for the 2.4-mL liner to ensure a tight fit. The liners are formed into two chambers and have a dome with a filling hole at the top. The inner and outer chambers are sealed from each other when the liner is compressed by the rotor lid (see Figure 1). During acceleration, fluid pressure develops and opens the seal (see Figure 2). The lightest particles in the sample, the chylomicrons, float into the inner chamber. During deceleration the chambers are sealed again, and the chylous material is isolated in the inner chamber. The 3.5-mL liner yields about 2.6 mL of clarified serum, and the 2.4-mL liner yields about 1.4 mL.

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

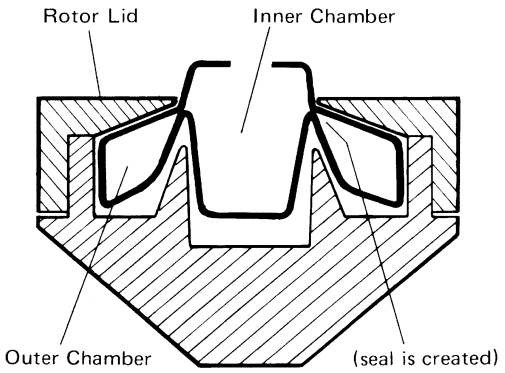


Figure 1. Before and After Centrifugation. The rotor lid compresses the liner, creating a seal between the inner and outer chambers.

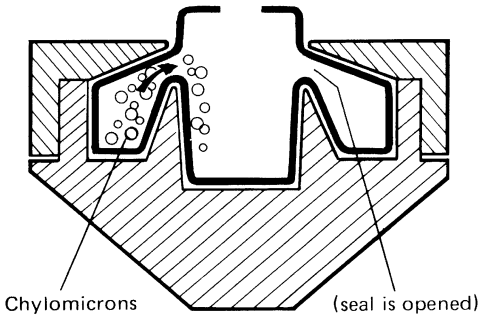


Figure 2. During Centrifugation. Fluid pressure develops and opens the seal.

[1] U.S. Pat. Nos. 3,958,753 and 3,456,875

[2] Delrin is a registered trademark of E. I. du Pont de Nemours & Company.

PREPARATION AND USE

Specific information about the ACR-90 rotor is given here. Use the Airfuge Ultracentrifuge instrument manual (publication AF-IM) together with this manual for complete rotor and accessory operating information.

WARNING

Normal operation may involve the use of solutions and test samples that are pathogenic, toxic, or radioactive. Operator error or tube failure may generate aerosols. Do not run toxic, pathogenic, or other hazardous materials in this rotor unless you take all appropriate safety precautions. Ask your laboratory safety officer to advise you about the level of containment required for your application and the proper decontamination or sterilization procedures to follow if fluids escape from containers.

ROTOR PREPARATION

1. Before using the rotor, inspect the rotor bushing. Replace a worn bushing (refer to MAINTENANCE).

2. Lightly lubricate the threads of the rotor base and lid with Spinkote™ lubricant (306812).

3. Place the rotor base in the stand.

4. *3.5-mL Liner*—Install the liner in the cavity of the base. Press the liner down firmly into the cavity.

   2.4-mL Liner—Place the adapter in the cavity (there is no right or wrong side of the adapter), then install the liner in the adapter. Press the liner down firmly into the cavity.

5. Insert a loaded pipette into the outer chamber of the liner (see Figure 3). Plastic loading pipette 343779 is recommended, or a glass Pasteur-type pipette may be used. The plastic pipette will slide in easily. If you use a glass pipette, insert it perpendicular to the molding seam of the liner and gently rotate the tip to encourage it past the wall of the inner chamber. If the tip breaks off, remove any sample and begin again with a new liner.

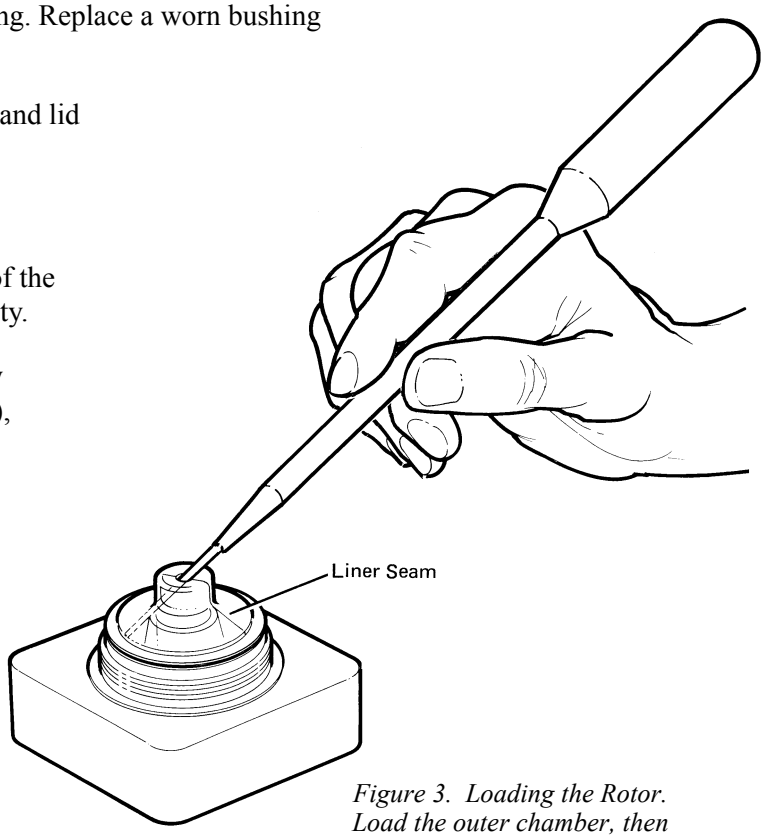


Figure 3. Loading the Rotor. Load the outer chamber, then install the rotor lid.

6. Fill the outer chamber until sample just overflows into the inner chamber.

7. Screw the lid onto the rotor base.

8. Fill the inner chamber until sample just touches the inside of the top of the dome. Do not overfill the liner, or sample will splash out and create aerosols during centrifugation.

OPERATION

1. Inspect the ultracentrifuge stator pad before use. A worn pad is smooth and shiny on the upper half of the inside surface (Figure 4). A shiny pad has lost its cushioning effect and will eventually cause rotor failure. Replace a worn stator pad (refer to publication AF-IM).

2. Ensure that the rotor is clean and dry, then carefully place it in the ultracentrifuge.

3. Set the TIME dial on the instrument for 10 to 12 minutes. Longer run times may cause intolerable evaporative loss. Refer to the instrument instruction manual for ultracentrifuge operation. Note the following for best results:

   - Unusual noise during centrifugation is an indication of rotor imbalance; make certain the rotor is properly loaded.

   - When the timer reaches zero, do not turn the air pressure regulator knob off until the rotor stops.

   - Do not open the instrument door until the rotor has stopped.

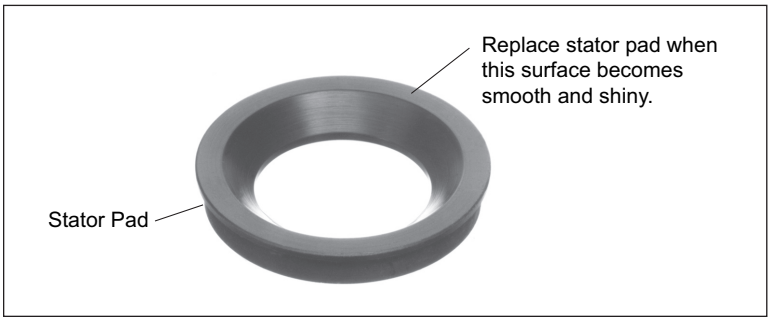


Figure 4. Ultracentrifuge Stator Pad

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 ultracentrifuge and accessories.

1. Remove the rotor from the instrument and place it in the stand.
2. Pipette the chylous material from the inner chamber while the lid is in place.
3. Unscrew the rotor lid.
4. Use a new pipette to extract the clarified serum from the outer chamber. Be careful not to mix any fatty material left on the wall of the inner chamber with the clarified serum.

NOTE

If the rotor lid is difficult to loosen after a run, and the sample cannot be removed, do not use metal tools on the rotor; it can be damaged. Do one of the following:

- Seat the rotor in the stand and wrap a piece of rubber tubing (such as latex tubing) or a rubber glove around the lid. Use the rubber to firmly grasp the lid, then twist the lid off.
- Place the rotor in a freezer for a few minutes—the aluminum base will contract more than the stainless steel lid. Remove the rotor, place it in the stand, then twist the lid off.

CARE AND MAINTENANCE

MAINTENANCE

Store the rotor in a dry environment (not in the instrument) with the lid removed. Refer to *Chemical Resistances* (publication IN-175) for the chemical compatibilities of rotor and tube materials. Your Beckman Coulter representative provides contact with the Field Rotor Inspection Program and the rotor repair center.

NOTE

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

Rotor Bushing

Regularly inspect the rotor bushing. Replace worn or damaged bushings as follows:

1. Remove the old bushing, using one tip of a forceps. Be careful not to scratch the rotor.
2. Place a new bushing (339639) into the rotor, beveled edge first.
3. Push the bushing in until it is flush with the rotor bottom. Lightly press the rotor against a flat surface to be sure the bushing is properly installed.

Rotor Threads

About twice a month, and whenever the rotor is washed, clean the threads of the base with alcohol, then lightly coat them with Spinkote lubricant (306812). Unlubricated threads may result in a stuck rotor lid.

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 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.

1. Wash the rotor using a mild detergent such as Beckman Solution 555™ (339555), that won't damage the rotor. Dilute the detergent 10 to 1 with water. Clean the rotor groove and tube cavities with a cotton-tipped swab.
2. Rinse thoroughly with distilled water.

3. Air-dry the rotor upside down. *Do not use acetone to dry the rotor.*

4. Clean the threads of the base and lid with alcohol, then lightly coat them with Spinkote lubricant.

DECONTAMINATION

If the rotor (and/or accessories) becomes contaminated with radioactive material, decontaminate it using a solution that will not damage the anodized surfaces. Beckman Coulter has tested a number of solutions and found two that 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 decontamination is expressed or implied. Consult your laboratory safety officer regarding the proper decontamination methods to use.

If the rotor components are contaminated with toxic or pathogenic materials, follow appropriate decontamination procedures as outlined by your laboratory safety officer. Check *Chemical Resistances* to be sure the decontamination method will not damage any part of the rotor.

STERILIZATION AND DISINFECTION

- The rotor can be autoclaved at 121°C for about 30 minutes. Place the rotor in the autoclave upside down, without a cap.

- Ethanol (70%)[5] may be used on all rotor components.

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.

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[3] In the United States, 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 the United States., contact Biodex Medical Systems (Shirley, New York); internationally, contact the U.S. office to find the dealer closest to you.

[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 sales office. It 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.

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 *Ultracentrifuge Rotors, Tubes, & Accessories* catalog (BR-8101) for detailed information on ordering parts and supplies. For your convenience, a partial list is given below.

NOTE

Publications referenced in this manual can be obtained by calling Beckman Coulter at 1-800-742-2345 in the United States, or by contacting your local Beckman Coulter office.

REPLACEMENT ROTOR PARTS

ACR-90 rotor assembly	341260
Rotor base bushing	339639
Rotor stand/vise	341252
Stator pad	339610
Reusable adapter for 2.4-mL liner	342635

OTHER

Disposable liner, 3.5-mL (pkg/100)	341251
Disposable liner, 2.4-mL (pkg/100)	342634
Plastic loading pipette (pkg/500)	343779
Rotor cleaning brush	339379
Spinkote lubricant (2 oz)	306812
Beckman Solution 555 (1 qt)	339555

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.

Beckman Coulter, Inc. • 250 S. Kraemer Blvd. • Brea, California 92821
Sales and Service: 1-800-742-2345 • Internet: www.beckmancoulter.com