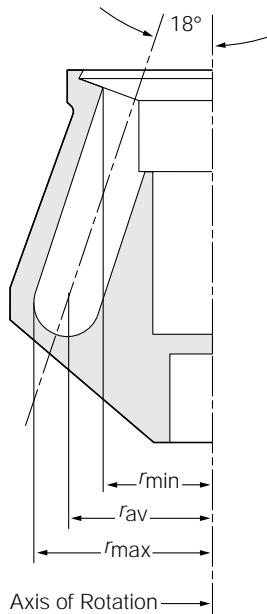


INSTRUCTIONS FOR USING THE A-110 ROTOR In the Beckman Coulter Airfuge® Ultracentrifuge



SPECIFICATIONS

Maximum speed (± 5000 rpm)	110 000 rpm
Air pressure at ultracentrifuge required	
for maximum speed	207 kPa (30 psig)
Density rating at maximum speed	1.2 g/mL
Relative Centrifugal Field* at maximum speed	
At r_{\max} (14.7 mm)	$199\,000 \times g$
At r_{av} (12.1 mm)	$164\,000 \times g$
At r_{\min} (9.5 mm)	$129\,000 \times g$
k factor at maximum speed	9
Number of cavities	6
Available tubes	see Table 1
Nominal tube dimensions	5×20 mm
Nominal tube capacity	180 μL
Nominal rotor capacity	1080 μL
Approximate acceleration	
time to maximum speed (fully loaded)	$1/2$ to 1 min
Approximate deceleration	
time from maximum speed (fully loaded)	$3\frac{1}{2}$ min
Weight of fully loaded rotor	42 grams
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:

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

DESCRIPTION

This rotor has been manufactured in an NSAI-registered ISO 9001 or 9002 facility for use with the specified Beckman Coulter ultracentrifuge.

The A-110 rotor, rated for 110 000 rpm at 207 kPa (30 psig), carries up to six microliter-size tubes at an angle of 18 degrees from the axis of rotation. The rotor, used with the Beckman Coulter Airfuge® Ultracentrifuge¹, can generate centrifugal forces to pellet sub-cellular components or to isolate microsomal fractions and plasma membranes. It can also be used to clarify small volumes of lipemic serum by flotation of the chylomicrons.

The rotor 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. Disposable rotor caps are made of polyethylene.

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

PREPARATION AND USE

Specific information about the A-110 rotor is given here. Use the Airfuge Ultracentrifuge instrument manual (publication AF-IM) together with this manual for complete instrument and rotor 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.

¹ U.S. Pat. Nos. 3,858,753 and 3,456,875

TUBES

The A-110 rotor uses the tubes listed in Table 1. Two, three, four, or six tubes can be centrifuged per run, if they are arranged symmetrically as shown in Figure 1. All tubes should be filled to the same level with liquid of the same density.

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. Refer to *Chemical Resistances* (publication IN-175) for information on the chemical resistances of tube and accessory materials.

Table 1. Available Tubes (5 × 20 mm) for the A-110 Rotor

Description	Part Number (pkg/100)	Maximum Fill Volume (μL)
Ultra-Clear®	344718	180
Polyallomer	342630	175

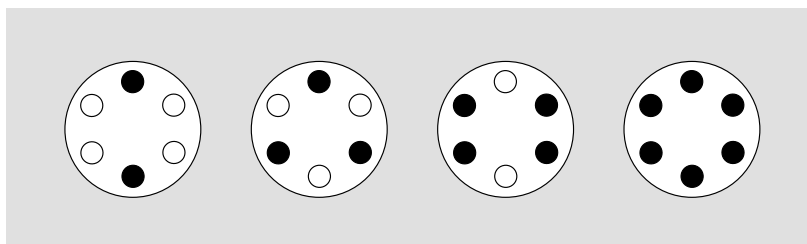


Figure 1. Arranging Tubes Symmetrically in the Rotor

ROTOR PREPARATION

NOTE

If solutes of low total concentration (1% or below) are pelleted, the sedimentation may be incomplete because the process is not entirely free of convection. To minimize convective disturbances, add sucrose or salt to the solution, or perform the run in a cold room. Follow the directions under *Cold Room Installation* in the Airfuge manual (AF-IM).

1. Before using the rotor, inspect the rotor bushing. Replace a worn bushing (refer to MAINTENANCE).
2. Load the tubes in the rotor cavities, using forceps.
3. Install a rotor cap (339643) by rubbing it into place in the rotor groove.



CAUTION

Do not run the rotor without a cap. Use a new cap for each rotor use.

OPERATION

1. Inspect the ultracentrifuge stator pad (Figure 2) before use. A worn pad, which is smooth and shiny on the upper half of the inside surface, 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. 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 2. Ultracentrifuge Stator Pad

**CAUTION**

Unusual noise during centrifugation is an indication of a missing rotor cap or load imbalance. Be sure a rotor cap is installed, and check the rotor for discrepancies in tube volumes or for asymmetrically placed tubes.

RUN TIMES

The k factor of the rotor (listed in SPECIFICATIONS) is a measure of the rotor's pelleting efficiency. Use the k factor in the following equations to estimate the run time, t (in hours), required to pellet particles of sedimentation coefficient, s (in Svedberg units, S).

$$t = \frac{k}{s} \quad (1)$$

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

$$k = k_{\text{max speed}} \left(\frac{110\,000 \text{ rpm}}{\text{actual run speed}} \right)^2 \quad (2)$$

RUN SPEEDS

Run speed is a function of the air pressure applied to the ultracentrifuge (see Figure 3). Run speeds achieved at pressures between 20 and 30 psig (141 and 207 kPa) are recommended. Speeds achieved at pressures below 20 psig may, in some cases, result in rotor instability.

The centrifugal force at a given radius in a rotor is a function of rotor speed. Comparisons of forces between different rotors can be made by comparing the rotor's relative centrifugal fields.

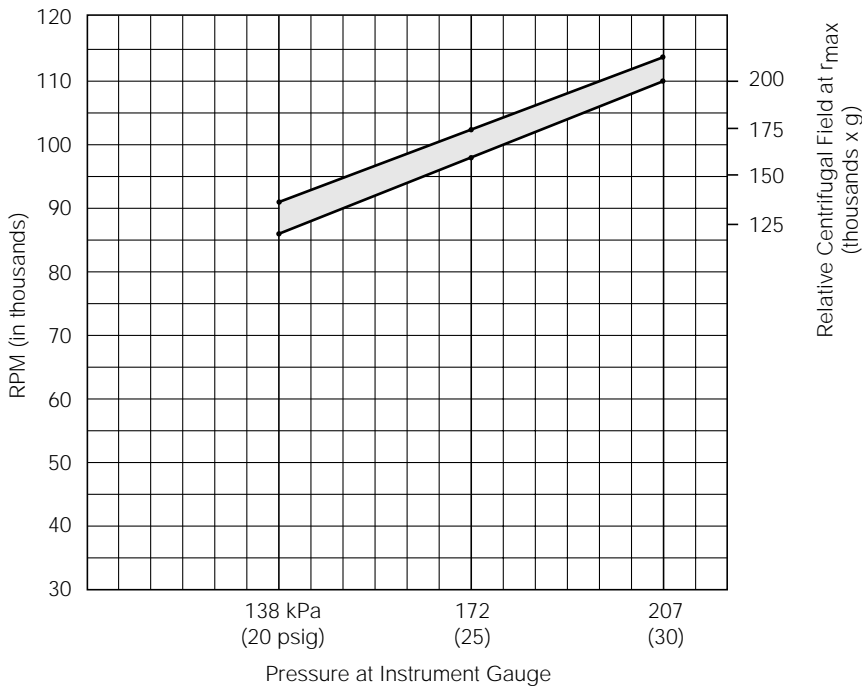


Figure 3. Nominal Rotor Speed vs. Air Pressure

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. Press the center of the cap to free an edge, then use forceps or your fingers to remove it (see Figure 4). Discard the cap.
3. Remove the supernatant from the tube with a pipette. Resuspend the pelleted material in a small volume of liquid, and then withdraw it from the tube with a pipette. When doing separations of lipemic serum, remove the clarified serum with a syringe needle or pipette inserted to the bottom of the tube.



*Figure 4. Removing the Rotor Cap.
Press in the center of the cap to free an edge.*

CARE AND MAINTENANCE

MAINTENANCE

Store the rotor in a dry environment (not in the instrument). Refer to *Chemical Resistances* 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.

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.*

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),² and Radiacwash.³

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.

² 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).

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

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%)⁴ 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.

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.***

⁴ Flammability hazard. Do not use in or near an operating ultracentrifuge.

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

NOTE

To obtain copies of referenced publications, contact Beckman Coulter, Inc., Technical Publications Department, 1050 Page Mill Road, Palo Alto, CA 94304, U.S.A. (telephone 650-859-1753; fax 650-859-1375).

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.

REPLACEMENT ROTOR PARTS

A-110 rotor assembly	354653
Rotor base bushing	339639
Stator pad	339610

OTHER

Rotor caps, polyethylene (pkg/20)	339643
Tubes	see Table 1
Tube rack	342707
Rotor cleaning brush	339379
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.

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