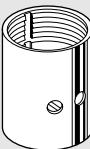


An-50 Ti and An-60 Ti Analytical Rotor, Cells, and Counterbalance



For Use with the Beckman Coulter Optima™ XL-A
and XL-I Analytical Ultracentrifuges



SAFETY NOTICE

This safety notice summarizes information basic to the safe use of the rotor described in this manual. The international symbol displayed above is a reminder to the user that all safety instructions should be read and understood before operation or maintenance of this equipment is attempted. When you see the symbol on other pages throughout this publication, pay special attention to the specific safety information presented. Observance of safety precautions will also help to avoid actions that could damage or adversely affect the performance of the rotor. This rotor was developed, manufactured, and tested for safety and reliability as part of a Beckman Coulter centrifuge/rotor system. Its safety or reliability cannot be assured if used in a centrifuge not of Beckman Coulter's manufacture or in a Beckman Coulter centrifuge that has been modified without Beckman Coulter's approval.



Handle body fluids with care because they can transmit disease. No known test offers complete assurance that they are free of micro-organisms. Some of the most virulent—Hepatitis (B and C) and HIV (I–V) viruses, atypical mycobacteria, and certain systemic fungi—further emphasize the need for aerosol protection. 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. Handle all infectious samples according to good laboratory practices and methods to prevent the spread of disease. Ask your laboratory safety officer to advise you about the level of containment required for your application and about the proper decontamination or sterilization procedures to follow if fluids escape from containers. 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. Because spills may generate aerosols, observe proper safety precautions for aerosol containment.



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 centrifuge.



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



Never exceed the maximum rated speed of the rotor and rotor components in use. Refer to the section on RUN SPEEDS.



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



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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SPECIFICATIONS — An-50 Ti ROTOR

| | |
|---|---|
| Maximum speed | 50 000 rpm |
| Number of rotor holes | 8 (7 for sample cells; 1 for counterbalance) |
| Relative Centrifugal Field* at maximum speed | |
| at cell center (6.5 cm). | 182 000 × <i>g</i> |
| at <i>r</i> _{max} of the cell sector (cell bottom, 7.2 cm) | 201 600 × <i>g</i> |
| Approximate acceleration time to maximum speed | 3 min |
| Approximate deceleration time from maximum speed | |
| to zero | 3 1/2 min |
| Available centerpieces. | see Table 1 |
| Weight, fully loaded rotor | max. 12 lbs |
| Rotor operating temperature range | 0 to 40°C |
| Rotor material | titanium |
| Rotor classification | R, T |



* 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:

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

SPECIFICATIONS — An-60 Ti ROTOR

| | |
|--|---|
| Maximum speed | 60 000 rpm |
| Number of rotor holes | 4 (3 for sample cells; 1 for counterbalance) |
| Relative Centrifugal Field* at maximum speed | |
| at cell center (6.5 cm) | 262 000 × g |
| at r_{max} of the cell sector (cell bottom, 7.2 cm) | 290 000 × g |
| Approximate acceleration time to maximum speed | 3 1/2 min |
| Approximate deceleration time from maximum speed to zero | 3 1/2 min |
| Available centerpieces | see Table 1 |
| Weight, fully loaded rotor | max. 12 lbs |
| Rotor operating temperature range | 0 to 40°C |
| Rotor material | titanium |
| Rotor classification | R, T |



* 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:

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

Section 1

DESCRIPTION

This section describes the An-50 Ti and An-60 Ti analytical rotors, cells, and counter-balances. Both rotors, classified R and T, are designed for use in Beckman Coulter Optima™ XL-A and Optima XL-I analytical ultracentrifuges. For complete operating instructions, XL-A customers whose systems use the Windows control software and all XL-I customers should use this manual along with the *Optima™ XL-I Analytical Ultracentrifuge Instruction Manual* (LXL/AI-IM). XL-A customers whose systems use the DOS control software should use this manual along with the *Optima™ XL-A Analytical Ultracentrifuge Instruction Manual* (LXL/A-IM) and the *Optima XL Instruction Manual* (LXL-IM).

THE ROTOR

These rotors have been manufactured in an NSAI-registered ISO 9001 or 9002 facility for use with the appropriately classified Beckman Coulter analytical ultracentrifuges.

- The An-50 Ti analytical rotor is an eight-place titanium rotor (painted black), rated for 50 000 rpm. Seven holes are for sample cells and the eighth is for the counter-balance; all are parallel to the axis of rotation.
- The An-60 Ti analytical rotor is a four-place titanium rotor (painted black), rated for 60 000 rpm. Three holes are for sample cells and the fourth is for the counter-balance; all are parallel to the axis of rotation.

In both rotors the cell holes, numbered for easy identification, together with the windows in the cells, allow light to pass through the cells for analysis of the material being centrifuged. A handle is attached for easy lifting of the rotor.

For overspeed protection, a photoelectric detector in the XL-A/XL-I analytical ultracentrifuge monitors the overspeed disk on the bottom of the rotor and shuts down the run if speeds exceeding the rotor's rated maximum are detected. In addition, magnets have been inserted in the overspeed disk between cell holes 1 and 4 (An-60 Ti) or 1 and 8 (An-50 Ti). A sensor in the rotor chamber, triggered by these magnets, is used for timing the light sources. Special care should be taken to avoid damaging this dual-purpose disk; always set the rotor down carefully on the rotor stand or drive spindle. (See Section 3: CARE AND MAINTENANCE for instructions on replacing the overspeed disk if it comes off or gets damaged.)

For warranty information, see the Warranty at the back of this manual.

THE CELLS

Each analytical cell consists of a centerpiece, two window assemblies, and a cell housing (see Figure 1-1). The 3-mm cell also requires two spacers. These components are designed with a special rib (key) on the housing, and groove (keyway) on other parts, which fit together to provide accurate alignment.

A 15-drawer storage cabinet is provided to hold cell components and tools (see the Supply List in Section 3).

DOUBLE-SECTOR CENTERPIECE

The standard double-sector centerpiece used in these rotors has two cavities, which are sector shaped to minimize convection and thus reduce mixing in the cell. The sample is contained in a sealed cavity formed by enclosing the centerpiece between two window assemblies.

- When the XL-A or XL-I absorbance optical system is used, as the spinning rotor passes through the light beam the system software automatically subtracts the solvent-only absorbance in one sector from the sample-plus-solvent absorbance in the other sector, so that the data represent the absorbance of the sample only.
- The XL-I interference optical system measures the refractive index difference between solvent and sample at each radial position, automatically subtracting the solvent-only index so that the data represent the refractive index of the sample only.

Centerpieces are 12 mm or 3 mm thick, representing the thickness of the liquid column that the light will pass through, and have a 2.5-degree sector angle. For Epon¹ centerpieces, the standard sector length is 14 mm, from cell top to cell bottom. The sector volume depends on the type of centerpiece being used (see Table 1-1).

Most of the centerpieces are made of Epon reinforced with either powdered aluminum or powdered charcoal. These centerpieces are used for centrifugation of aqueous, biological materials of pH 3 to 10. The charcoal-filled Epon centerpieces are used, typically, if the possibility of aluminum ions contaminating the sample will affect the results. (See Section 3: CARE AND MAINTENANCE for more information on the solvent compatibility of filled-Epon centerpieces, as well as on their general care and handling.)

¹ An epoxy; Epon is a registered trademark of Shell Chemical Corp.

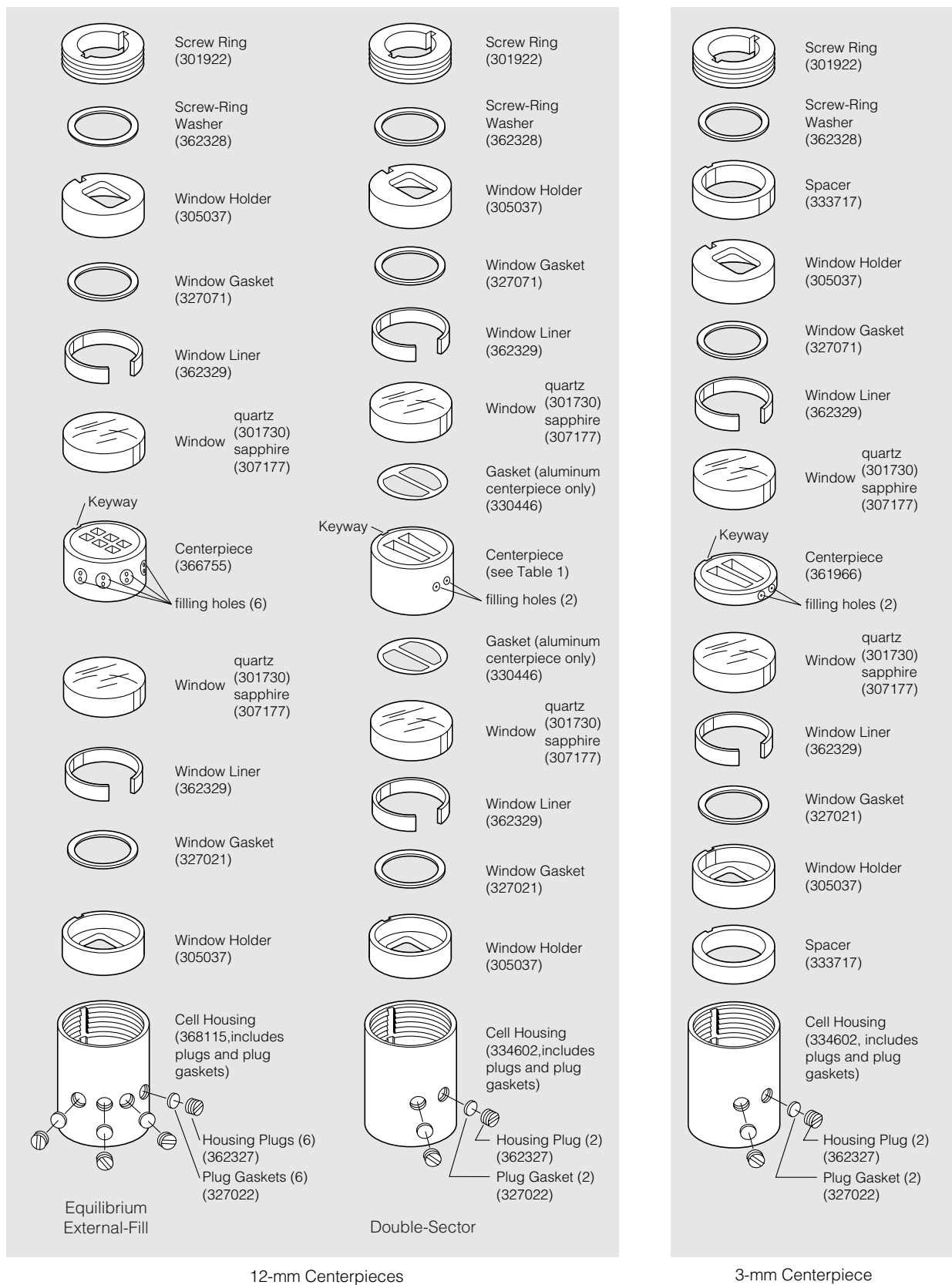
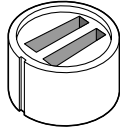


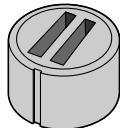
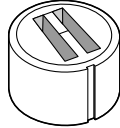


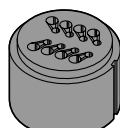
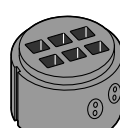


Figure 1-1. Exploded View of Double-Sector and Equilibrium External-Fill Analytical Cells

Table 1-1. Centerpieces for the An-50 Ti and An-60 Ti Cells

| Type | | Material | Part Number | Fill Volume (mL) | Recommended Maximum Speed (rpm) |
|--|---|----------------------------|---------------------|----------------------------------|---------------------------------|
| Standard Double Sector |  | aluminum | 334623 | 0.45 per sector | 60 000 |
| |  | 12-mm Epon charcoal-filled | 306493 | 0.45 per sector | 42 000 |
| |  | 3-mm Epon charcoal-filled | 361966* | 0.12 per sector | 42 000 |
| |  | Epon aluminum-filled | 305685 | 0.45 per sector | 42 000 |
| Synthetic Boundary Capillary-type |  | Epon charcoal-filled | 331431 | 0.4 solvent 0.15 sample | 42 000 |
| | | Epon aluminum-filled | 306076 | | |
| Band Forming |  | Epon charcoal-filled | 331359 | 0.01 per well 0.35 per sector | 42 000 |
| Equilibrium Six-channel |  | Epon charcoal-filled | 331376 [†] | 0.12 per channel | 48 000 |
| Equilibrium Eight-channel |  | Epon charcoal-filled | 361851 | 0.025 per channel | 50 000 |
| Equilibrium Six-channel with External-Fill |  | Epon charcoal-filled | 368116 [‡] | 0.12 per channel | 48 000 |

* Two spacers (333717) required.

[†] Housing kit (335402) required.[‡] Housing kit (368115) required.

**SIX-CHANNEL OR EIGHT-CHANNEL EQUILIBRIUM CENTERPIECE
(WITHOUT EXTERNAL-FILL)**

The six-channel equilibrium centerpiece is designed for centrifugation of three sample-solvent pairs simultaneously. Three channels hold solvent, and three channels hold sample-solvent mixture. Each channel holds a liquid column about 3 mm high or less from base to meniscus; this short column height greatly reduces the time required to reach equilibrium in sedimentation equilibrium studies.

The eight-channel equilibrium centerpiece is similar to the six-channel, except it is designed for centrifugation of four sample-solvent pairs simultaneously, enabling increased sample throughput and lower loading volumes. Four channels hold solvent, and four channels hold sample-solvent mixture. The channels are parallel and the column height is short. The eight-channel centerpiece is designed for use with interference optics—the holes are spaced in line with the slits for the laser output. (The timing of the flash lamp with absorbance optics will not give equal intensities between the parallel channels of this centerpiece.)

SYNTHETIC BOUNDARY CENTERPIECE

Synthetic boundary centerpieces are designed to layer one solution onto another solution during centrifugation. Two capillaries are scribed on the face of the synthetic boundary centerpiece, between the sectors. Solution from one sector flows into the other through the lower capillary while air flows out through the upper capillary. The quick formation of the boundary allows you to make measurements during the time that would otherwise be required for the boundary to clear the meniscus. This is particularly helpful when working with solutes that have low sedimentation rates, or with rapidly diffusing solutes that might never clear the meniscus in the usual boundary velocity run.

With the absorbance optical system, this centerpiece is used to determine the diffusion coefficient of the sample. With the interference optical system, the centerpiece is used for preliminary experiments to determine the total number of fringes that characterize the concentration of solutions to be studied. The synthetic boundary centerpiece can be used with the interference system to determine the extinction coefficient of the sample.

SIX-CHANNEL EQUILIBRIUM EXTERNAL-FILL CENTERPIECE

The six-channel external-fill centerpiece has the same sector dimensions and filling requirements as the standard six-channel centerpiece, but is designed to be loaded and unloaded without disassembling the cell. The ability to run a cell empty, with buffer, and then with solution allows the user to subtract out any window or cell artifacts. The centerpiece has a filling hole to each side of the sector. Each pair of filling holes is located on the outside of the centerpiece. The cell housing has six filling holes and brass screws that align with the centerpiece filling holes. The centerpiece can be used in either orientation in the housing; however, for consistency it is best to load the centerpiece so the numbers on the centerpiece and cell housing are in the same orientation when assembled.

BAND-FORMING CENTERPIECE

Band-forming centerpieces are designed to transfer sample from the sample well onto a sedimentation solvent in the sector during centrifugation. The sample flows from the sample well through the capillary scribed on the face of the centerpiece and onto the surface of the sedimentation solvent in the sector. After the sample has migrated onto the solvent, diffusion of the small molecules between the two layers generates a gradient to stabilize the sedimenting band. When sedimentation rates of components of the sample differ sufficiently, two or more bands form and sedimentation proceeds without interaction between components.

This centerpiece is used for measuring sedimentation constants from the rate of movement of the band center of the sample. If enzyme activity can be monitored by absorbance, the sedimentation of an active enzyme can also be measured by sedimentation through substrate.

HOLMIUM OXIDE CENTERPIECE

A special holmium oxide centerpiece is used to validate instrument wavelength calibration. *The maximum speed permitted for this centerpiece is 3000 rpm, run without a vacuum to prevent cracking.* This centerpiece has holmium oxide calibration glass mounted in the center in the sample side of a standard 12-mm double-sector centerpiece. The glass is held in place with epoxy cement. As with other components, it is very important to keep the glass very clean. See CARE OF THE HOLMIUM OXIDE CENTERPIECE in Section 3.

WINDOWS

Quartz windows and sapphire windows are available for use in the cells. Typically, quartz windows are used with the XL-A/XL-I absorbance optical system because of the wide range of light that they transmit. The sapphire windows are recommended for use with the interference optical system; they are essential for good fringe patterns at speeds above 30 000 rpm because they produce less light refraction at higher speeds. However, they block transmission of light below approximately 240 nm.

Both types of windows fit into the same cell assembly hardware, including a vinylite gasket, a Bakelite liner, and an aluminum holder. Both types of windows must be handled carefully and checked before each use. The quality of older quartz windows should be checked before use as described in INSPECTING QUARTZ WINDOWS in Section 3. Sapphire windows, which have an "X" etched on the edge, are harder than quartz and can be expected to have a longer life.

CELL HOUSINGS

A special screw ring and washer (see Figure 1-1) seal the cell components into the standard and six-channel external-fill cell housings. Housing plugs and associated gaskets seal the filling holes after the centerpiece is filled.

The cell housing for the six-channel (without external-fill) equilibrium centerpiece is different in that it has a screw ring and washer at *each* end. Also, the channels are filled directly—making filling holes and plugs unnecessary.

THE COUNTERBALANCE

The counterbalance (see Figure 1-2) is anodized red to distinguish it from Beckman Coulter Model E counterbalances, which should not be used in the An-50 Ti or An-60 Ti. The counterbalance must be positioned in cell hole 4 (An-60 Ti) or cell hole 8 (An-50 Ti); it is used to provide a reference for calibrating radial distances and to balance the opposing cell.

For rotor balance, the counterbalance must be weighted with aluminum, brass, and/or tungsten weights (supplied with the counterbalance) to ensure that it weighs within *0.5 gram* of the opposite loaded cell. Installing these weights is described in PREPARING THE COUNTERBALANCE in Section 2.

A small setscrew in the top of the counterbalance is used to secure the counterbalance in the rotor.

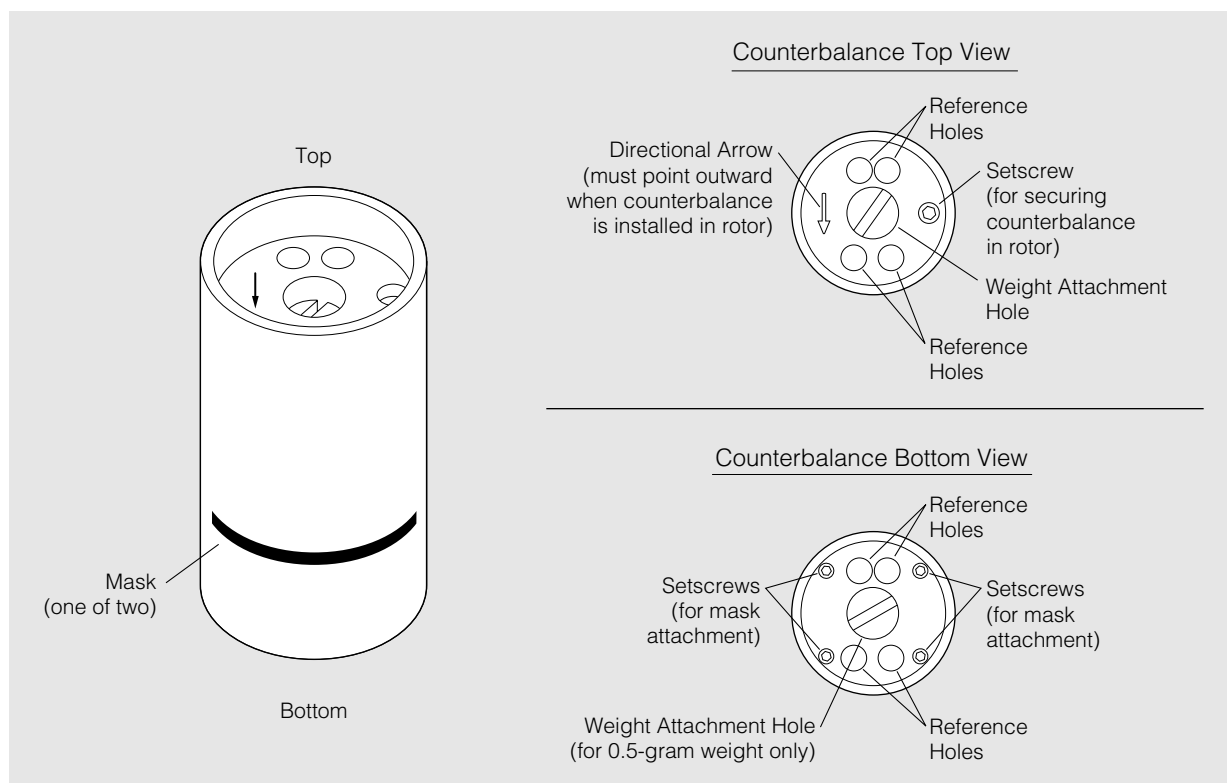


Figure 1-2. The Counterbalance

COUNTERBALANCE CALIBRATION

The XL-A and XL-I systems automatically calibrate the system software based on the known position of the counterbalance. As light passes through pairs of inner and outer reference holes in the counterbalance, known radial distances in the cell and the distances between reference edges (of the reference sector) are used to calibrate the system.

NOTE

Calibration should be performed at a low speed, such as 3000 rpm. If calibration is done at low speed, the software factors in rotor stretch when higher speeds are run.

When using the absorbance optical system, you can request the Windows control software to perform a counterbalance calibration by clicking the **Options** button on the .SCN window and then checking the **Radial calibration before first scan** box (Figure 1-3). Calibration will occur as the first scan begins. If you are using an XL-A with DOS control software, you can request counterbalance calibration by selecting **Execute Scan** from the main menu (Figure 1-4). See the XL-A instruction manual (LXL/A-IM) for detailed instructions.

Calibrating the counterbalance when the interference optical system is used first requires selecting reference edges on the camera image shown on the PC monitor, and then initiating the calibration procedure via the XL-I Windows control software. These procedures are described in the XL-A and XL-I instruction manual (LXL/AI-IM).

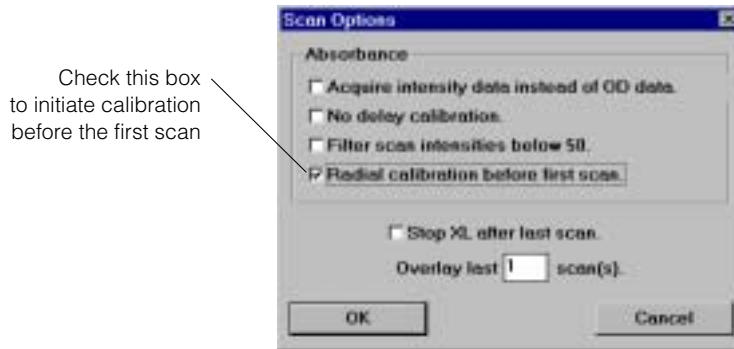


Figure 1-3. Initiating Radial (Counterbalance) Calibration with the Absorbance Optical System

| Set Up Scan | Execute Scan | Display Scan | Utilities | eXit |
|-------------|--------------------|---------------|-------------|----------|
| | Review active cell | Status : | Calibrating | Baseline |
| | sTart scan | Cell # : | 4 | |
| | Stop scan | radius : | 7.118 | CM |
| | start Auto scan | Wavelength : | 886 | NM |
| | stOp XL | Speed : | 3000 | RPM |
| | sPecial | Elapse Time : | 8833 | Seconds |
| | | Temperature : | 25 | Celsius |

Figure 1-4. XL-A DOS Version User Interface Screen Indicating Calibration of Cell 4 (Counterbalance)

Section 2

PREPARATION AND USE

Keep the rotor on its stand whenever possible to avoid damaging the overspeed disk. If it is necessary to cool the rotor prior to the run, refrigerate the cells after they have been assembled.

 **NOTE**

Although rotor components and accessories made by other manufacturers may fit in the An-50 Ti or An-60 Ti rotor, their safety in this rotor cannot be ascertained by Beckman Coulter. Use of other manufacturers' components or accessories in this 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.

Analytical accessories manufactured by Beckman Coulter for use in the Model E analytical ultracentrifuge cannot be used in the An-50 Ti or An-60 Ti rotor.

BEFORE GETTING STARTED

Use the checklist below each time you use the rotor to ensure that all components are clean and in proper working order.

- Wash and dry new components before they are used for the first time.
- Inspect all cell components and replace any that are damaged or show signs of wear.
- Check that the screw-ring threads are clean and free of burrs, and that the screw-ring washer is clean and not deformed or broken.

- Check that the window holders are not distorted, that window gaskets are clean and not damaged, and that window liners are not frayed at the edges.
- Lightly lubricate all components with aluminum surfaces (cell housing, screw ring, etc.) with Spinkote™ lubricant (306812) to prevent scratches and abrasion where these components contact each other.
- Check that the windows are not cracked or scratched in the area that will cover the sectors.
- *Make sure that the windows are scrupulously clean—without fingerprints, smudges, dust, or lint.* See Section 3 for detailed cleaning instructions. Once windows are clean, handle them by the edges only, using a lintless tissue.
- Be sure that the centerpiece face and the wall between the centerpiece sectors are not scratched, cracked, or irregularly shaped, and that the capillaries in synthetic boundary centerpieces are in good condition.
- Check that the cell-housing threads are clean and not nicked, that the housing keyway is not nicked, that the filling holes are clean and free of burrs, and that the housing itself is not deformed.
- *When using more than one cell, use the same type of centerpieces in opposing cells to ensure that the assembled cells weigh within 0.5 gram of each other.* (An imbalanced load can move the center of rotation slightly, causing an erroneous reading.)
- For optimal results, rebuild cells identically between uses so that you can easily identify repetitive noise in multiple data sets.

ASSEMBLING STANDARD AND SIX-CHANNEL EXTERNAL-FILL CELLS

STEP 1: ASSEMBLE WINDOWS (Two windows are needed per cell.)

- a. Place a window gasket (see Figure 2-1) in the window holder. (Use gaskets only a few times, as they become bent or otherwise damaged with repeated use.)
- b. Place a liner in the window holder, over the gasket, with the gap in the liner *opposite* (180 degrees) from the keyway.
- c. Hold the window with a lintless tissue and carefully insert it into the holder, aligning the mark with the keyway. (It helps to drop the window in at a slight angle, starting at the keyway.) *Make sure that no fingerprints or smudges get on the window.*
- d. Repeat instructions *a* through *c* for the second window assembly.

If you are using band-forming centerpieces, you must add sample before proceeding. Refer to Step 5 below for instructions. If you are using six-channel equilibrium centerpieces without external-fill, refer to the special instructions following Step 8.

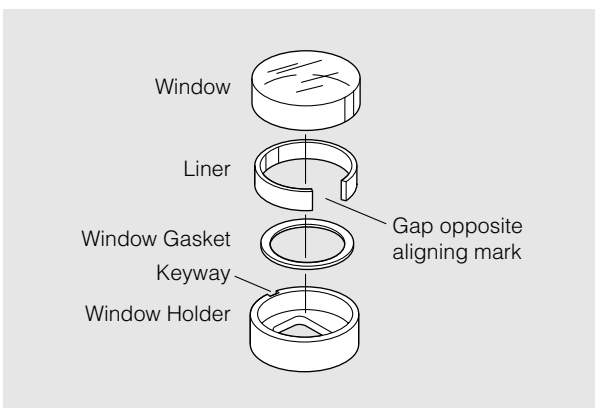


Figure 2-1. Assembling Window Components

STEP 2: STACK THE CENTERPIECE AND WINDOW ASSEMBLIES.

- a. *Double check that all cell components are scrupulously clean* —to prevent leakage or damage to the centerpieces.
- b. With the keyways aligned, stack the components in this order: window assembly on the bottom (window up), centerpiece in the middle (capillaries facing down in synthetic boundary centerpieces), and window assembly on top (window down); see Figure 2-2 or Figure 2-3.

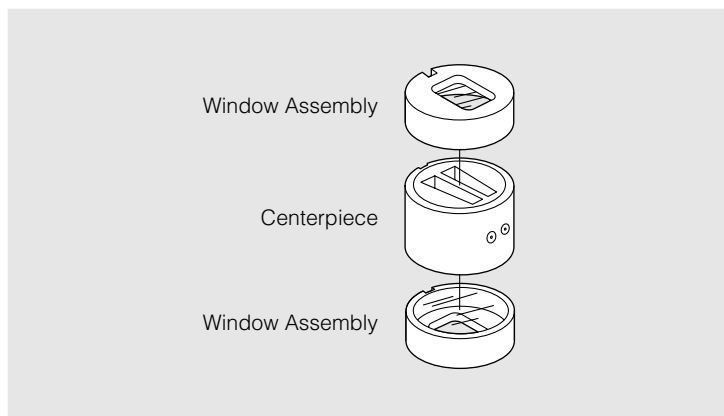


Figure 2-2. Stacking 12-mm Centerpiece and Window Assemblies

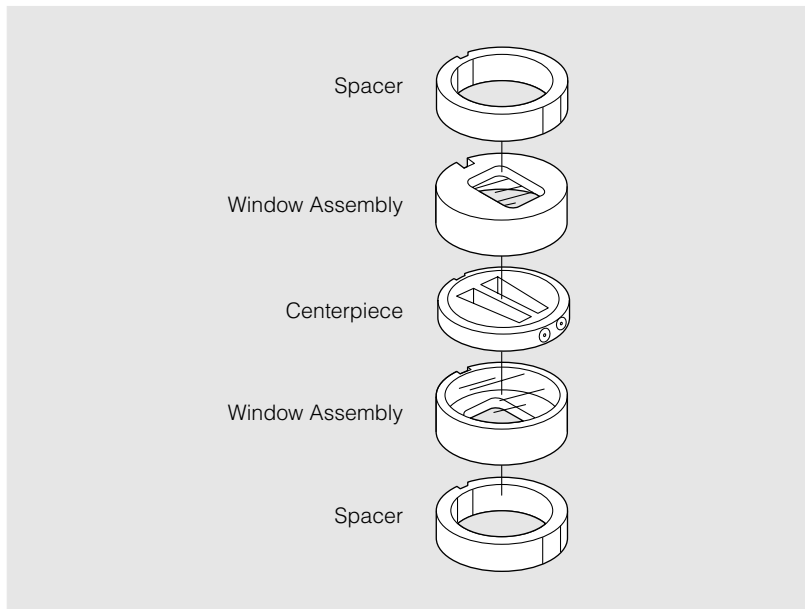


Figure 2-3. Stacking 3-mm Centerpiece, Window Assemblies, and Spacers

If you are using the aluminum centerpiece (334623), place one red polyethylene gasket (330446) between the centerpiece and the window assemblies (two gaskets per centerpiece; see Figure 1-1). Align the center strip of the gasket with the centerpiece septum (see orientation shown in Figure 1-1). To insert the gasket, bend it slightly to fit the two opposite edges into the centerpiece, then smooth it around until all but one edge fits in. Push in the remaining edge.

- c. Align the cell-housing key with the keyways, then push the housing down over the components.
- d. Turn the cell housing upright and, using moderate pressure, carefully push the components to the bottom with the cell-aligning tool (see Figure 2-4).

The cell can also be assembled by sliding the components into the housing individually. To do so, hold the housing threaded-end up and slide the lower window assembly to the bottom of the housing with the window up. (For a 3-mm centerpiece, slide a spacer into the housing before inserting the window assembly.) Then insert the centerpiece followed by the upper window assembly with the window down. Add another spacer for a 3-mm centerpiece.

Do not force components into the housing. If they do not slide easily, check again for dirt or burrs. If a component becomes distorted, replace it.

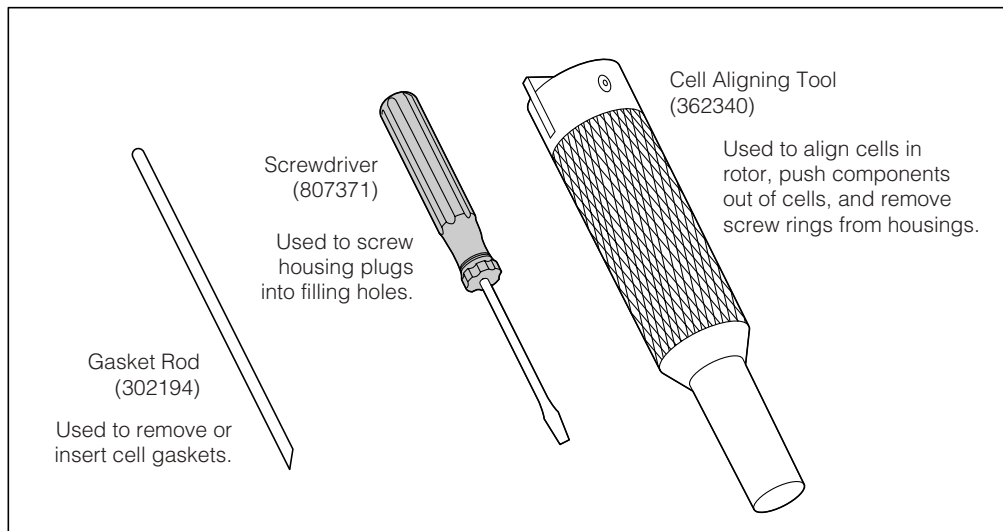


Figure 2-4. Required Tools for Cell Assembly

STEP 3: INSERT THE SCREW RING INTO THE HOUSING.

- a. Apply a thin film of Spinkote lubricant to both sides of the screw-ring washer and to the threads of the screw ring (Figure 2-5) after the cell components are in place.
- b. Place the lubricated washer into the housing on top of the window holder.

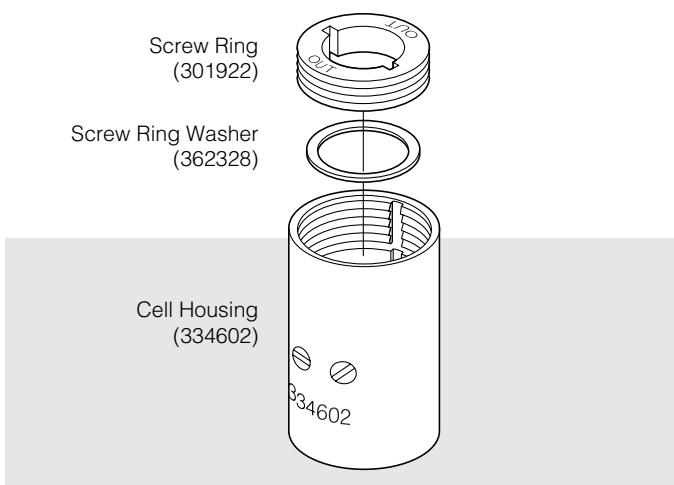


Figure 2-5. Cell Housing, with Screw Ring and Washer

- c. Orient the screw ring so that the side inscribed “OUT” is facing up. Begin turning the screw ring manually, then use the flat end of the cell-aligning tool to finish screwing the ring into the housing.

 **NOTE**

The screw has a buttress thread. Forcing the ring to screw in the wrong way will strip the threads and ruin the housing.

STEP 4: TIGHTEN THE SCREW RING.

- a. Place the cell housing in the cell torque collet. (Refer to *How to Use the Cell Torque Wrench* [E-TB-016], for detailed instructions on using this tool.)
- b. If a 12-mm centerpiece is used, use the torque wrench to tighten the screw ring to about 120 inch-pounds. If a 3-mm centerpiece is used, tighten the screw ring to 135 inch-pounds to prevent leakage at higher run speeds.
- c. Release the torque from the collet and remove the cell from the vise. **DO NOT** touch the windows.

STEP 5: FILL THE CENTERPIECES.



Normal operation can involve the use of reagents which may be toxic or biologically harmful. Observe all cautionary information printed on the original solution containers prior to their use. Dispose of all waste solutions in a proper manner. Handle infectious samples according to good laboratory procedures and methods to prevent spread of disease.

- a. To avoid scratching the sector surfaces, fill the centerpieces using either an adjustable pipette with gel-loading tips, or a syringe and Hamilton polyethylene tubing (Figure 2-6).

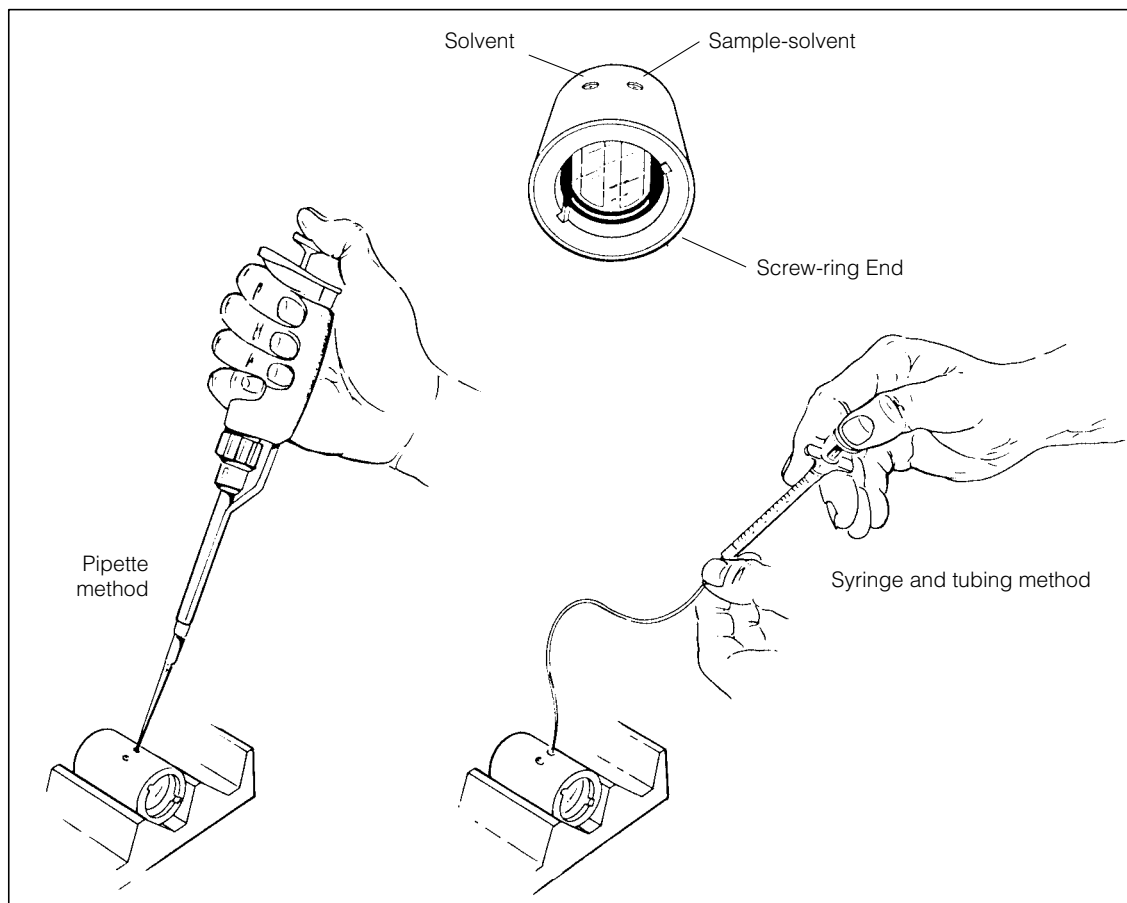


Figure 2-6. Filling a Standard Double-Sector or Six-Channel External-Fill Centerpiece

b. Fill centerpieces using the appropriate procedure.

- *Standard double-sector centerpieces.* Each sector holds a maximum volume of about 0.45 mL. Hold the cell horizontally with the screw-ring end toward you and the filling holes up. Fill the reference (left) sector with solvent; fill the sample (right) sector with sample-solvent mixture (see Figure 2-6). Use a greater total volume (usually 10 to 20 μL) in the reference sector so that the sample meniscus is easily recognized.
- *Six-channel equilibrium external-fill centerpieces.* Turn the housing right side up; hold it with the housing holes to your left. Looking into the housing, the front (reference) row of channels is for solvent only; the back (sample) row is for sample plus solvent. Load 0.10 to 0.12 mL of sample/solvent into the back row of channels, and 0.11 to 0.13 mL of solvent only into the front channels. The difference in channel volumes (approximately 0.01 mL) provides a slight separation in the menisci patterns of each pair, making distinction of the menisci easier in the final scan.
- *Synthetic boundary capillary-type centerpieces.* The centerpiece should be placed in the housing with the capillaries up. Load the centerpiece as described above for standard centerpieces. Fill the reference (left) sector with 0.40 mL of solvent; fill the

sample (right) sector with about 0.15 mL of sample-solvent mixture or just to the capillary. The volume of sample in the (right) sector must be such that the meniscus (when running) is below the transfer capillary.

- *Band-forming centerpieces.* The sample wells must be filled before the cell is completely assembled. After inserting the first window assembly and centerpiece into the housing, hold the cell upright with the filling holes away from you. From the top, load 0.01 mL of sample into the right sample well; load 0.01 mL of buffer into the left sample well (Figure 2-7). Finish assembling the cell by adding the final window assembly, screw ring and washer, as described in Steps 2 through 4.

After the cell is torqued, hold it horizontally with the screw-ring end toward you and the filling holes up. Fill each sector with about 0.35 mL of buffer (or up to the capillary).

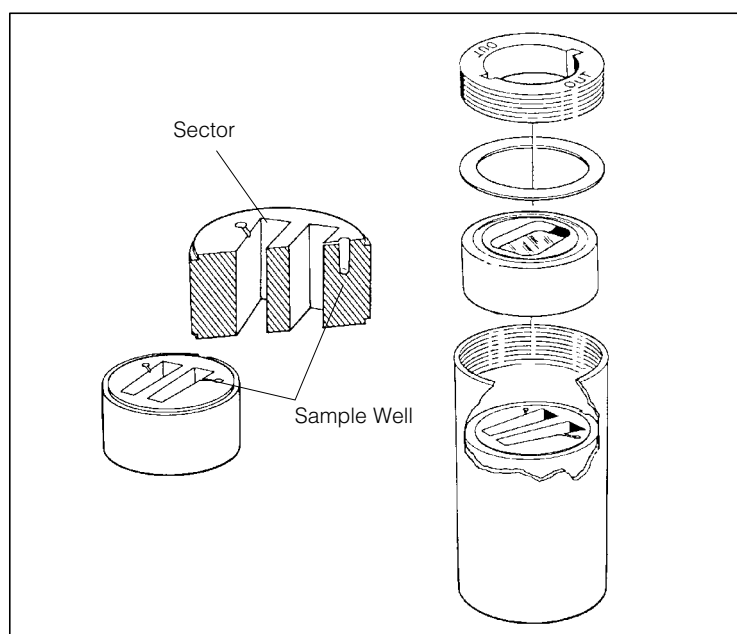


Figure 2-7. Filling a Type I Band-Forming Centerpiece

STEP 6: SEAL THE FILLING HOLES.

- Place a new red polyethylene plug gasket on each filling hole (see Figure 2-8).
- Screw the housing plugs in, using the small flat-edge screwdriver provided. Hand tighten the plugs—DO NOT tighten them too much or the housing will distort, making installation into the rotor very difficult. Centrifugal force on the plugs will seal the filling holes.

NOTE

The brass screws can be tightened to seat loose-fitting cells more snugly.

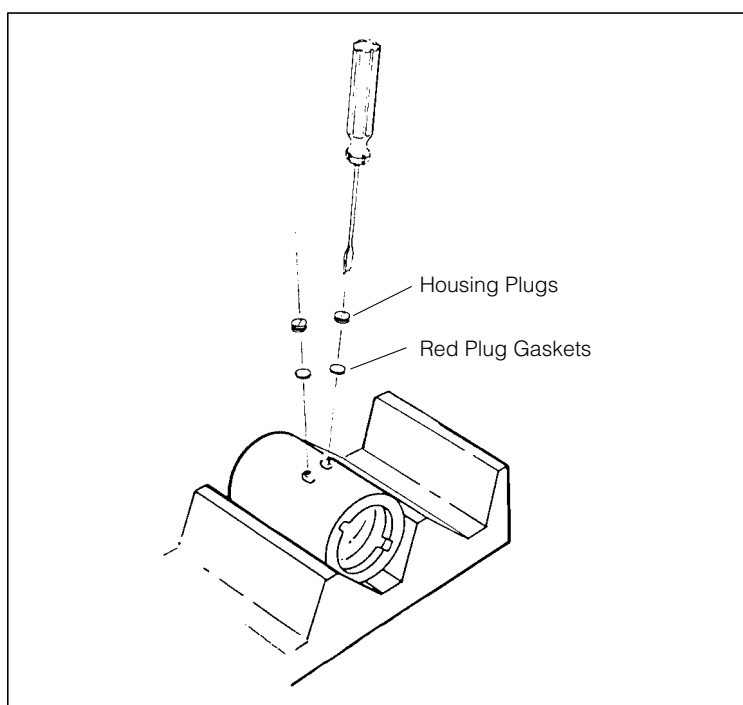


Figure 2-8. Sealing the Filling Holes

STEP 7: ASSEMBLE OTHER CELLS IF REQUIRED.

Follow Steps 1 through 6 above to assemble cells 2 and 3 (An-60 Ti) or 2 through 7 (An-50 Ti), if required.

STEP 8: WEIGH THE ASSEMBLED CELLS.

- a. Weigh the assembled cells. Make sure that opposing cells weigh within 0.5 gram of each other. (If they do not, recheck that the centerpieces are alike and the volumes similar.)
- b. Proceed directly to PREPARING THE COUNTERBALANCE and LOADING THE ROTOR, below. (Skip the following section on equilibrium centerpieces.) Be sure that when weighed, the counterbalance is equal to or up to 0.5 gram lighter than the opposite cell.

ASSEMBLING CELLS THAT USE THE EQUILIBRIUM CENTERPIECE WITHOUT EXTERNAL-FILL

The cell housing for the six-channel or eight-channel equilibrium centerpiece is special in that it has a screw ring and washer at each end (see Figure 2-9) and does not use housing plugs or gaskets. (The holes in the housing are used as a reference point only.) The top of the housing is defined as the end that is up when the part number inscribed on the side of the housing is right side up.

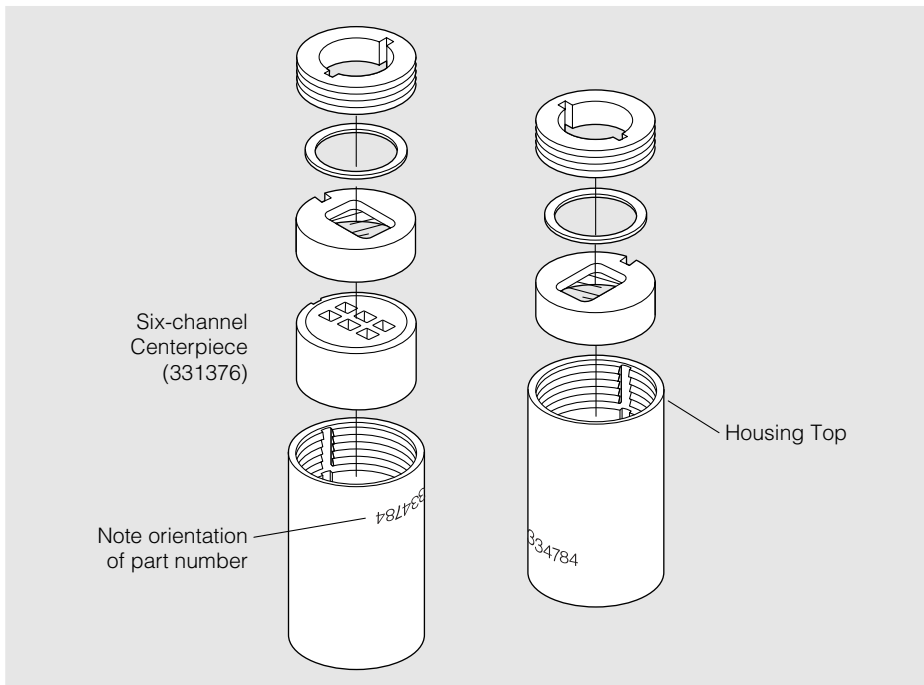


Figure 2-9. Assembling the Six-Channel Equilibrium Centerpiece Without External-Fill.
Eight-channel centerpiece assemblies are similar.

1. Turn the housing upside down (part number will be upside down), then slide the centerpiece into the housing as far as it will go, aligning the keyway with the housing key. Add the lower window assembly, *window down*, and the window liner towards the keyway.
2. Apply a thin film of Spinkote lubricant (306812) to the two screw-ring washers and to the threads of the two screw rings. Place a lubricated washer on the window assembly. Screw in the lower screw ring, using the flat end of the cell-aligning tool.
3. Torque the first screw ring to 60 inch-pounds, using the cell torque wrench.

4. Turn the housing right side up; hold it with the housing holes to your left. Looking into the housing, the front (reference) row of channels is for solvent only; the back (sample) row is for sample plus solvent (Figure 2-10).
 - a. Prepare a syringe with delivery tubing attached (such as Hamilton polyethylene tubing) or use adjustable pipettes with gel-loading disposable tips.
 - b. Load 0.10 to 0.12 mL of sample/solvent into the back row of channels, and 0.11 to 0.13 mL of solvent only into the front channels. The difference in channel volumes (approximately 0.01 mL) provides a slight separation in the menisci patterns of each pair, making distinction of the menisci easier in the final scan.
5. After the centerpiece is filled, slide the upper window assembly—window down and window liner towards the keyway—into the cell housing. Place a lubricated screw-ring washer on top and screw in the lubricated ring.

NOTE

Be careful not to spill the centerpiece contents before the final torque (step 7).

6. Torque the second screw ring to 120 inch-pounds, using the cell torque wrench.
7. Turn the cell over and torque the lower ring to 120 inch-pounds, using the cell torque wrench.

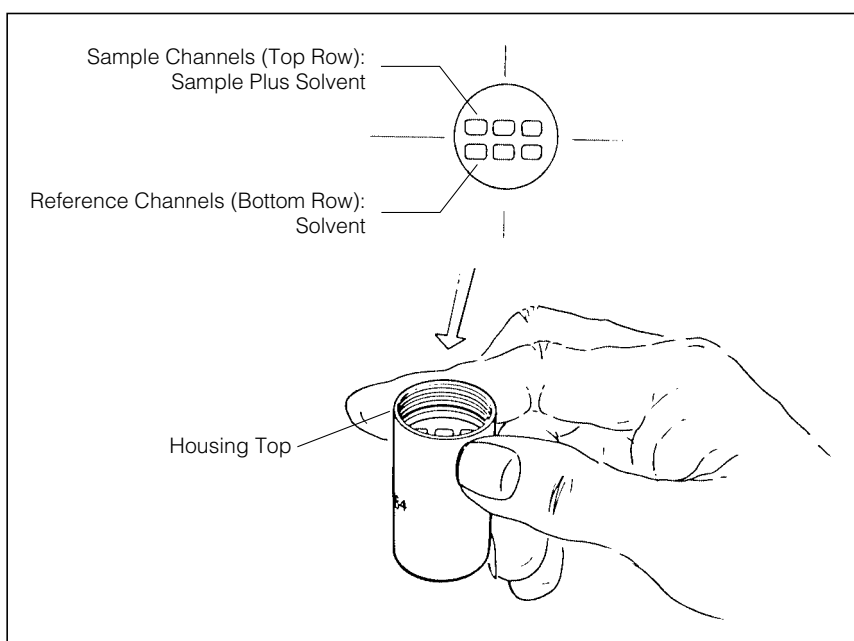


Figure 2-10. Reference and Sample Channels. Six-channel centerpiece shown; eight-channel centerpiece channels are referenced the same as the six-channel.

8. Place the cell (with the six-digit part number right side up) into the rotor so that the three channels with the highest concentration of sample are toward the center of the rotor. If the cell fits loosely, remove it and insert plug gaskets and screws into the housing holes and tighten slightly. Return the cell to the rotor.

PREPARING THE COUNTERBALANCE

The aluminum, brass, and tungsten weights supplied in the counterbalance set are numbered in 1-gram increments (labeled on end); each set also includes a 0.5-gram aluminum weight.

1. Screw weights into the weight attachment hole at the top of the counterbalance (see Figure 2-11) so that the counterbalance weighs within 0.5 gram of the assembled cell.
2. If you need to use the 0.5-gram weight, screw it into the weight attachment hole at the bottom of the counterbalance.

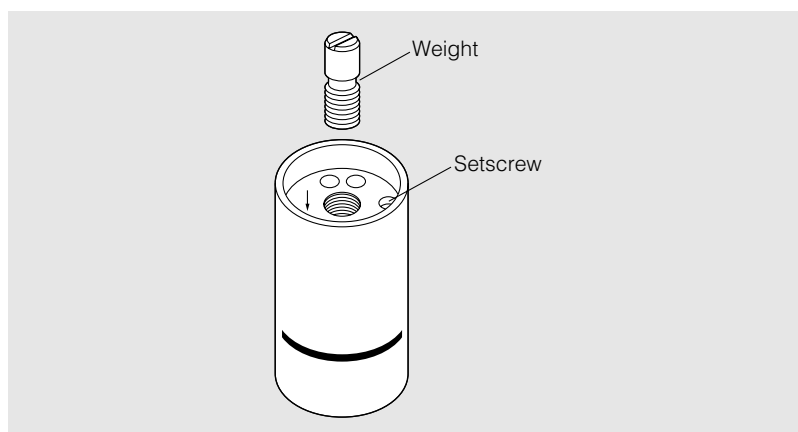


Figure 2-11. Inserting Weights into the Counterbalance



CAUTION

Do not let the weights protrude from the top or bottom of the counterbalance. They must be flush or slightly indented. Protruding weights can get sheared off during centrifugation, which will result in damage to the rotor and the ultracentrifuge.

Two removable masks (see Figure 2-12), each containing a sample sector and a smaller reference sector, must be properly installed in the counterbalance to ensure accurate system calibration. The masks are factory-installed. If you remove them, or if they loosen and fall out, reinstall them as described below.

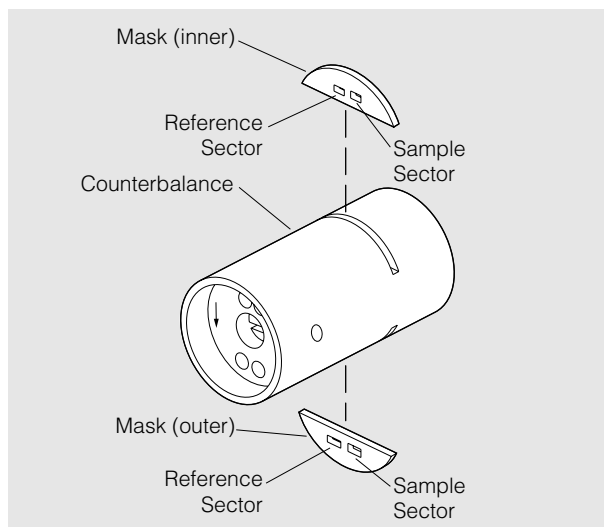


Figure 2-12. Inserting Masks into the Counterbalance

1. Using the small allen wrench from the counterbalance kit, loosen the two setscrews holding each mask in place (these setscrews are located on the bottom of the counterbalance). The masks will fall out as the setscrews are loosened.
2. Note that one mask is engraved “I” (for inner) and the other is engraved “O” (for outer). Reinstall them as shown in Figure 2-12, making sure that the “I” and the “O” face the bottom of the counterbalance (away from the end with the directional arrow).

LOADING THE ROTOR

Before loading the rotor, check the special analytical overspeed disk on the rotor bottom. If it is scratched, damaged, or missing, replace it according to the instructions in Section 3.

Load the counterbalance into cell hole 4 (An-60 Ti) or 8 (An-50 Ti) as follows.

1. Place the counterbalance in the cell hole, making sure that the arrow points away from the center of rotation.
2. Use a small allen wrench to tighten the setscrew (which in turn pushes a nylon plug out the side of the counterbalance) until movement of the counterbalance requires slight force.

3. Line the counterbalance scribe line slightly to the left (counterclockwise) of the rotor scribe mark. Then use the allen wrench to tighten the screw while twisting the counterbalance just enough to match up the two scribe lines (see Figure 2-13).

NOTE

Placing a mirror under the rotor, as shown in Figure 2-13, will let you see the scribe line without having to turn the rotor on its side.

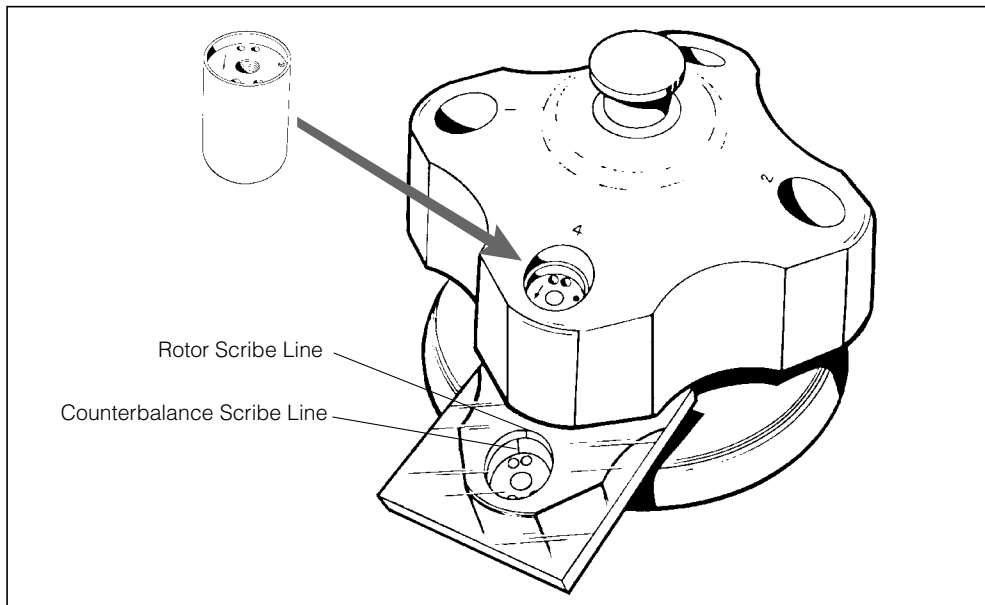


Figure 2-13. Loading the Counterbalance into the Rotor. Scribe lines are reflected in the mirror (An-60 Ti rotor shown).

Load assembled cells into cell holes 1 through 3 (An-60 Ti) or 1 through 7 (An-50 Ti) as follows.

1. Install each assembled cell with the screw-ring end up and the housing filling holes *toward the center* of the rotor. Match the scribe line on each cell with the scribe line in each rotor hole. Make sure that each cell assembly fits snugly enough that it does not turn in the cell hole or fall out of the rotor while you are aligning the other cells.
 - *An-60 Ti* — One, two, or three sample cells may be run. If you are running only one sample cell, load it into cell hole 2 (opposite the counterbalance). If you are running two sample cells, place an assembled, empty cell in cell hole 2 and place the two sample cells in positions 1 and 3. Always make sure that the counterbalance weighs the same as or within 0.5 gram less than the cell in position 1, and that the sample cells in all other opposing positions weigh within 0.5 gram of each other.

- *An-50 Ti* — Up to seven sample cells may be run. If you are running only one sample cell, load it into cell hole 4 (opposite the counterbalance). If you are running two sample cells, place an assembled, empty cell in cell hole 4 and place the two sample cells in positions 2 and 6. If you are running more than two cells, load additional assembled cells in opposing positions. Always make sure that the counterbalance weighs the same as or within 0.5 gram less than the cell in position 4, and that the sample cells in all other opposing positions weigh within 0.5 gram of each other.
2. Refrigerate or warm the rotor and assembled cells, if required, prior to the run.

PREVENTING CELL LEAKAGE

Cell leakage can occur through the filling holes, across centerpiece faces to the outside of the cell, and from sector to sector. Massive leaks in which sample escapes the cell, such as if a window breaks, cause a temporary loss in chamber vacuum, which will be reported as a diagnostic message on the Optima XL-A/XL-I screen. Minor leaks can be identified only by the resulting movement of the menisci toward the cell bottom on the scan.

- *Filling-hole leaks* result from the plugs and gaskets not completely sealing the holes. This is most likely due to damage to the recess around the centerpiece filling holes. During this minor leakage, only solvent vapor is lost from the cell, so the movement of the menisci will be slow but observable. Also, convection in the cell may result from cooling of the upper layers of the cell contents as the top layer evaporates.
- *Leaks across the face of the centerpiece* result from scratches or dirt on the centerpiece and/or window faces, or from inadequate tightening of the cell housing. If the screwing threads are not lubricated, the friction may prevent adequate pressure from being applied to the window-centerpiece junction, causing the cell to leak. Keep the threads clean and lubricated. If leaks still occur, either increase the torque to 140 inch-pounds or try putting a *very thin* film of silicone vacuum grease on the centerpiece faces.
- *Sector-to-sector leaks* occur only if the fill levels of the two sectors differ by more than approximately 5 μL . Typically, sector-to-sector leakage is indicated by a single observable meniscus on the scan (or meniscus disappears if exactly overlaid). In almost all applications, you should use slightly less sample than reference (buffer); however, make sure that the fill levels differ by no more than 5 μL . Also keep in mind that using similar fill levels reduces the stress on the wall between the sectors and minimizes possible damage. If it is not feasible to use similar fill levels, increase the torque on the cell to about 140 inch-pounds or put a *very thin* film of silicone vacuum grease on the centerpiece faces.
- *If leakage is due to a damaged centerpiece*, replace the centerpiece.
- *In the six-channel or eight-channel centerpiece*, cell leakage can occur from channel to channel in the direction of centrifugal force. This leakage is identified by change in the menisci. If you detect leakage and centerpieces are clean and not distorted, try putting a *very thin* film of silicone vacuum grease on the centerpiece faces for the next run.

LOADING THE ROTOR INTO THE CENTRIFUGE

Carefully lower the rotor straight down onto the analytical ultracentrifuge drive shaft. Consult the Optima XL-A or XL-I instruction manual for detailed information on operating the ultracentrifuge.

SELECTING A RUN SPEED

The maximum rated speed of the An-60 Ti rotor is 60 000 rpm and maximum speed for the An-50 Ti rotor is 50 000 rpm. However, rotor speed may be limited by the type of centerpiece being used (see Table 1-1). Double-sector centerpieces are not recommended for routine use at speeds greater than those listed. A sudden loss of chamber vacuum indicates major leakage; if this occurs, abort the run.



CAUTION

Double-sector Epon centerpieces are speed rated lower than the rotor maximum because the septum between the centerpiece sectors can break or be damaged if leakage occurs while the centerpiece is running at higher speeds. With care, these centerpieces can be run up to the rotor maximum; however, Beckman Coulter is not responsible for warranty replacement of any parts broken or deformed as a result of running at speeds higher than those recommended in Table 1-1.

DO NOT exceed the recommended maximum speed for six-channel or eight-channel centerpieces—breakage or permanent deformation will result.

DISASSEMBLING CELLS AFTER THE RUN



WARNING

Normal operation can involve the use of reagents which may be toxic or biologically harmful. Observe all cautionary information printed on the original solution containers prior to their use. Dispose of all waste solutions in a proper manner. Handle infectious samples according to good laboratory procedures and methods to prevent spread of disease.

After the run, remove the cells from the rotor, using the cell-aligning tool. Then follow the instructions below to disassemble the cells.

STANDARD DOUBLE-SECTOR AND SIX-CHANNEL EXTERNAL-FILL EQUILIBRIUM CELLS

1. Unscrew and remove the housing plugs using the flat-edge screwdriver.
2. Remove the plug gaskets with the gasket rod or forceps and discard them. *Be careful not to scratch the centerpiece.* Withdraw the sector contents through the filling holes.
3. Loosen the screw-ring using the cell torque wrench.
4. Remove the screw-ring using the cell-aligning tool if necessary. Remove the washer.
5. Place the cell threaded-end down on a work table. Push the components out by pressing against them with your finger while lifting the housing up.
6. Push the windows out of the holders using the cell-aligning tool and thoroughly wash and dry *all* components (see CLEANING in Section 3 for instructions). Check the condition of the window holders. If necessary, replace parts; then reassemble.
7. Clean and dry the centerpiece, following the instructions in Section 3. Remove and discard the gaskets from aluminum centerpieces.
8. Store all cell components in a dust-free environment.

CELLS WITH SIX-CHANNEL OR EIGHT-CHANNEL EQUILIBRIUM CENTERPIECES WITHOUT EXTERNAL-FILL

1. Orient the housing with the part number facing up and loosen the top screw ring, using the torque wrench.
2. Remove the screw ring using the flat end of the cell-aligning tool, and remove the washer using the gasket rod or forceps.
3. Using forceps, carefully remove the upper window assembly from the housing. *Be careful not to scratch the window.* Wipe the window with a lintless tissue.
4. Place a tissue in the housing to soak up the liquid contents of the centerpiece.
5. Turn the housing over and use the torque wrench to loosen the bottom screw ring. Remove the screw ring and washer.
6. With both screw rings removed, place the housing upright on the work table. Push the tissue, centerpiece, and lower window assembly out of the housing with your finger while lifting the housing off. **DO NOT** push against the centerpiece itself with any tool.
7. Remove the windows from the holders using the cell-aligning tool and then clean *all* cell components, according to the instructions in Section 3.

Section 3

CARE AND MAINTENANCE

This section describes general rotor care as well as specific procedures for the care and maintenance of the cells and counterbalance.

MAINTENANCE

- Do not use sharp tools on the rotor or components. Corrosion begins in scratches—the potential for damage from corrosion is greatest in aluminum components.
- Regularly inspect the overspeed disk. If it is scratched, damaged, or missing, replace it (see below).
- Regularly inspect and clean the rotor and cell components. Regularly lubricate cell components with aluminum surfaces (cell housing and screw ring) *lightly* with Spinkote lubricant (306812). Decontaminate and/or sterilize components as required.
- Regularly check the cell holes for accumulation of excess lubrication or leaked sample. If necessary, clean with a cotton swab.
- Store the rotor in a dry environment (not in the instrument).
- Store cell components and tools in the cabinet provided (see the Supply List). Special inserts have been designed for the drawers to protect the various components and tools while not in use.

Refer to *Chemical Resistances* (publication IN-175) for chemical resistances of rotor and rotor component materials. A list of chemicals that should not be used with filled Epon centerpieces follows later in this chapter. Your Beckman Coulter representative can provide contact with the Field Rotor Inspection Program (FRIP) and the rotor repair center.

CARE OF FILLED-EPON CENTERPIECES

Filled-Epon centerpieces are made from an epoxy resin, with either a powdered aluminum or carbon filler. The aluminum filler increases the strength and thermal conductivity of the Epon. The carbon filler makes the centerpiece opaque. After machining, the aluminum-filled

centerpieces are soaked in a 20% solution of aluminum hydroxide to remove surface aluminum. The absorption of water by filled-Epon is negligible. Some solvents, however, may penetrate the centerpiece and soften it slightly. Generally, any softening effects can be eliminated by rinsing the centerpiece with distilled water after the run. The following chemicals are known to cause excess softening and should not be used with Epon centerpieces:

- glacial acetic acid
- 27% or greater aqueous ammonia
- chloroform
- diethylene triamine
- ethylene diamine
- 40% aqueous formaldehyde
- meta-cresol
- N,N-dimethyl formamide
- greater than 10% nitric acid
- 85% phosphoric acid
- 70% sulfuric acid
- tetrahydrofuran

This list is not exhaustive, and use of any nonaqueous solvent with Epon centerpieces is not recommended. Refer to *Chemical Resistances* for more detailed information.

CARE OF THE HOLMIUM OXIDE CENTERPIECE

The holmium oxide centerpiece is made by mounting holmium oxide glass in a standard 12-mm double-sector centerpiece, using epoxy cement.

- Be sure to keep the glass very clean; however, avoid using solvents or other liquids that could soften the centerpiece material or epoxy cement.
- Do not soak the centerpiece in any liquid for prolonged periods of time. Otherwise, clean the centerpiece as you would clean other spectrophotometer cell parts.
- Dry the centerpiece with a hot air blower or under a vacuum. However, do NOT use compressed air to dry off the centerpiece as this may leave minute oil droplets on the glass.
- Do not run this centerpiece above 3000 rpm.

INSPECTING QUARTZ WINDOWS

Due to the wavelength capabilities of the Optima XL-A/XL-I absorbance optical system, it is very important that the quartz windows used have an absorbance of less than 0.1 AU in the 190 to 800 nm range. The windows shipped with the rotor assembly have been factory checked to ensure compliance with this specification. Check the absorbance of previously purchased windows as follows.

1. Clean the window and then check to make sure that it is clear and not scratched or otherwise damaged. Older windows may be scratched or have a yellow tint, both of which will inhibit transmission. (Even microscopic scratches can affect transmission.)
2. Use a spectrophotometer to check window absorbance. First, run a background wavelength scan from 190 to 800 nm with nothing in the light path. Then place the window to be tested in the sample light path and perform several scans, each time changing the window position slightly. This will give you several measurements in the area of the window where sample will be scanned during operation of the Optima XL-A/XL-I. Note that most readings above 0.1 AU will occur at lower wavelengths (below approximately 240 nm).

REPLACING THE ANALYTICAL OVERSPEED DISK

A specially designed analytical overspeed disk (see Figure 3-1) is affixed to the bottom of the rotor as part of the photoelectric overspeed detection system. Magnets are embedded in this overspeed disk. A sensor in the rotor chamber, triggered by the magnets, is used for timing the flash lamp strobe. Check regularly that the disk is properly affixed and is not scratched or damaged. To replace a damaged or missing disk, follow the instructions below. (The standard 30-sector or 36-sector overspeed disk CANNOT be substituted for this one.)

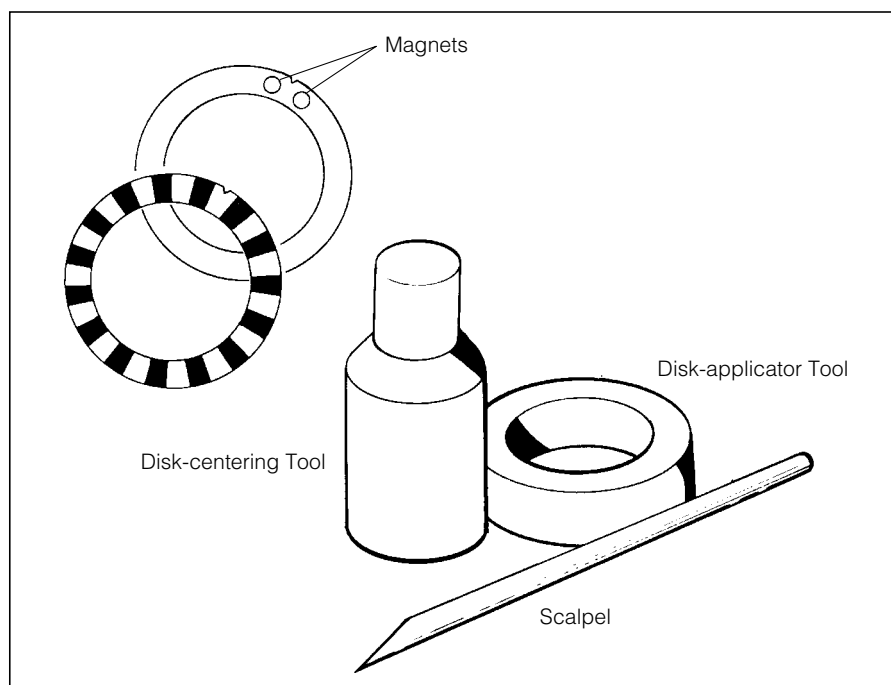


Figure 3-1. The Analytical Overspeed Disk and Required Tools

1. Assemble these items (see Figure 3-1).
 - Replacement overspeed disk (360256, An-60 Ti, or 363784, An-50 Ti)
 - Disk-centering tool (331325; comes with the ultracentrifuge)
 - Disk-applicator tool (360529; comes as part of the rotor starter kit)
 - Scalpel (optional, not supplied; use only if old disk needs to be removed)
2. Place the rotor upside down on the lab bench. (The rotor must be dry and at room temperature because the adhesive will not stick to a damp surface.)
3. If an old disk needs to be removed, carefully pry up the edges with a scalpel and then peel off the disk. *Be careful not to scratch the rotor.* (If necessary, clean the area around the drive hole with acetone to remove any old adhesive.)
4. Insert the centering tool into the rotor drive hole until the lip of the tool makes contact with the rotor. (If necessary, hold the tool down to allow air to escape from the hole.)
5. Carefully peel off the backing from the new disk; make sure that *all* paper is removed. (It is easier to begin peeling the backing away from the magnets.) After the backing is removed, hold the disk by its edges to avoid touching the adhesive.
6. Find the aligning marks on the bottom of the rotor (see Figure 3-2). Orient the notch on the overspeed disk between the aligning marks (with adhesive facing down), then slide the disk down the centering tool until it touches the rotor. (The notch must be centered between the marks so that the magnets will be correctly placed between cell holes 1 and 4 on the An-60 Ti, or cell holes 1 and 8 on the An-50 Ti). Be sure not to bend the disk, as you may break the magnets.

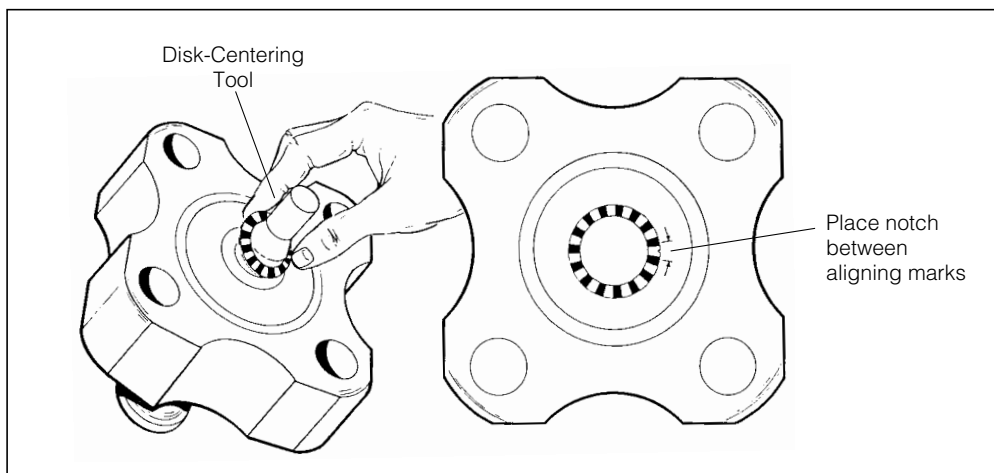


Figure 3-2. Correctly Aligning the Analytical Overspeed Disk on the Rotor
(An-60 Ti shown)

- When the disk is properly oriented, press it down using the applicator tool with about 5 lb (2 kg) of force to ensure complete adherence.

**CAUTION**

Be sure to use the applicator tool. This tool affixes the overspeed disk to the rotor smoothly and completely, ensuring proper overspeed protection and detection of the magnets embedded in the disk.

- Remove the applicator and centering tools; return them to their appropriate place in the rotor component cabinet.
- Allow the disk to set for at least 24 hours before using the rotor.

CLEANING

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

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

- Wash the rotor body in a mild detergent, such as Beckman Solution 555™, that will not damage the rotor. Scrub the cell holes with a nonabrasive brush. The Rotor Cleaning Kit (339558) contains two special plastic-coated brushes and two quarts of Solution 555 for use with rotors and accessories. Dilute the detergent 10 to 1 with water.

NOTE

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

- Thoroughly rinse the cleaned rotor with distilled water and allow to air dry. *Do not use acetone to dry the rotor.*

Cell windows and centerpieces should be cleaned after every run as described below.

- Wipe the cell windows with a lintless tissue.
- Wash the centerpieces by soaking them in warm distilled water.
- If necessary, clean the sectors with a cotton-tipped swab.

If cell leakage has occurred, wash all components (cell housings, centerpieces, windows, window holders, window liners, screw rings, washers, and gaskets) in a mild detergent solution (Beckman Solution 555, diluted 10 to 1 with water, is recommended). Rinse cleaned components in distilled water and *dry them thoroughly*. To prevent corrosion, be sure that components are completely dry before they are stored.

DECONTAMINATION

If the rotor and/or cell components become contaminated with toxic or pathogenic materials, follow appropriate decontamination procedures as outlined by your laboratory safety officer. Check *Chemical Resistances* for acceptable solutions that will not damage the rotor or components. (Strong bases and/or high-pH solutions can damage aluminum components.)

STERILIZATION AND DISINFECTION

The rotor body can be autoclaved at 121°C for up to an hour. Of all cell components, only aluminum centerpieces can be autoclaved at 121°C. *Do not autoclave Epon*; use a cold sterilization method only. Ethanol¹ (70%) may be used on the rotor and cell 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 Sales Office. It should contain the following information:

- serial number,
- a 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.

¹ Flammability hazard. Do not use in or near operating ultracentrifuges.

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 components to:

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

Attention: Returned Goods

SUPPLY LIST

NOTE

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

Call Beckman Coulter Sales (1-800-742-2345 in the United States; worldwide offices are listed on the back cover of this manual) for detailed information on ordering parts and supplies. For your convenience, a partial list is given below.

REPLACEMENT ROTOR AND CELL COMPONENT PARTS

| | |
|---|---------------|
| An-50 Ti rotor assembly | 363782 |
| An-60 Ti rotor assembly | 361964 |
| Analytical overspeed disk (36-sector; 50 000 rpm) | 363784 |
| Analytical overspeed disk (30-sector; 60 000 rpm) | 360256 |
| Centerpieces | see Table 1-1 |
| Cell housing kit: double-sector with screw ring and gasket, plugs and gaskets (does not include window assembly) | 334602 |
| Cell housing kit: six-channel equilibrium, with two screw rings and gaskets (does not include window assembly) | 335402 |

| | |
|--|--------|
| Cell housing kit; six-channel equilibrium external-fill, with screw ring and gaskets (does not include window assembly) | 368115 |
| Counterbalance and weights | 360219 |
| Gaskets | |
| aluminum centerpiece, red polyethylene (pkg of 10) | 330446 |
| housing plug, red polyethylene (pkg of 100) | 327022 |
| window, white vinylite (pkg of 100). | 327021 |
| Housing plugs, brass (pkg of 6) | 362327 |
| Screw ring, cell housing | 301922 |
| Spacer for 3-mm centerpiece (2 required) | 333717 |
| Window assembly (quartz window, holder, gasket and liner) | 334597 |
| Window, quartz | 301730 |
| Window, sapphire. | 307177 |
| Window holder, aluminum. | 305037 |
| Window liner, Bakelite (pkg of 6) | 362329 |
| Washer, screw ring, Bakelite (pkg of 6). | 362328 |

TOOLS AND MISCELLANEOUS SUPPLIES

| | |
|--|--------|
| Cell-aligning tool | 362340 |
| Gasket rod | 302194 |
| Hamilton fittings and tubing | 961332 |
| Holmium oxide calibrating centerpiece | 362331 |
| Housing plug (flat-edge) screwdriver. | 807371 |
| Overspeed disk applicator tool. | 360529 |
| Overspeed disk centering tool | 331325 |
| Rotor Cleaning Kit. | 339558 |
| Silicone vacuum grease (1 oz) | 335148 |
| Solution 555 (1 qt) | 339555 |
| Spinkote lubricant (2 oz) | 306812 |
| Storage cabinet for cell components, 15-drawer | 961524 |
| Torque stand assembly (collet-type) | 361318 |
| FC-43 oil, 1/2-ounce dropper bottle | 306394 |
| DC-550 oil, silicone, 1/2-ounce dropper bottle. | 307673 |

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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