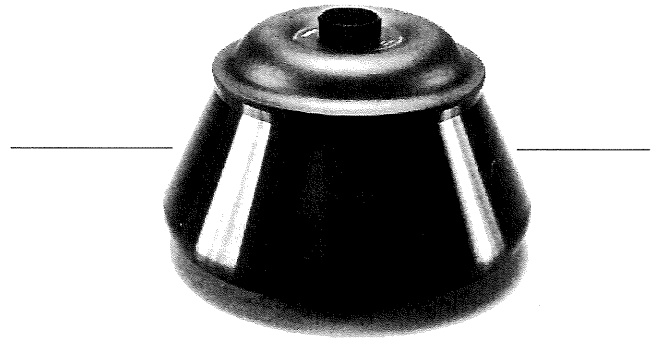


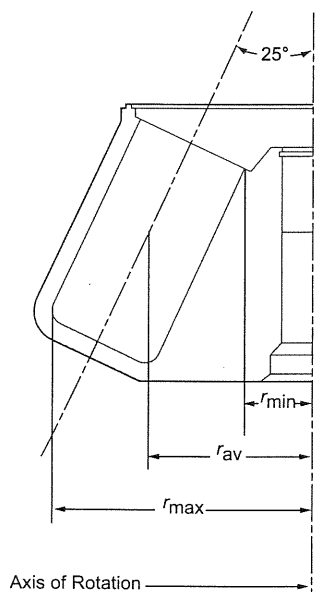
## JA-14 Fixed Angle Rotor



Used In Beckman Coulter J2, J6,  
and Avanti® J Series Centrifuges

# JA-14 FIXED ANGLE ROTOR

## SPECIFICATIONS



U.S. Pat. No. 3,901,434; 4,850,951  
 British Pat. No. 1,465,099  
 Canadian Pat. No. 1,001,597  
 German Pat. No. 2,448,199

Maximum speed .....	14 000 rpm
Critical speed range* .....	600 to 800 rpm
Maximum solution density .....	1.2 g/mL
Maximum allowable imbalance of opposing loads .....	10 grams
Relative Centrifugal Field† at maximum speed	
At $r_{max}$ (137 mm) .....	$30\ 100 \times g$
At $r_{av}$ (86 mm) .....	$18\ 900 \times g$
At $r_{min}$ (35 mm) .....	$7\ 680 \times g$
$k$ factor at maximum speed .....	1764
Number of bottle cavities .....	6
Available bottles and tubes .....	see Table 1
Nominal dimensions of largest bottle .....	$62 \times 120$ mm
Nominal bottle capacity .....	250 mL
Nominal rotor capacity .....	1.5 liters
Approximate acceleration time to maximum speed (rotor fully loaded) .....	4 min
Approximate deceleration time from maximum speed (rotor fully loaded, max. brake) .....	4 min
Weight of fully loaded rotor .....	13.6 kg (30 lb)
Rotor material .....	aluminum
Conditions requiring speed reduction .....	see RUN SPEEDS
Rotor entry code for Avanti J-E centrifuges and microprocessor-controlled J2 and J6 centrifuges .....	14

\* The critical speed range is the range of speeds over which the rotor shifts so as to rotate about its center of mass. Passing through the critical speed range is characterized by some vibration.

† 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:

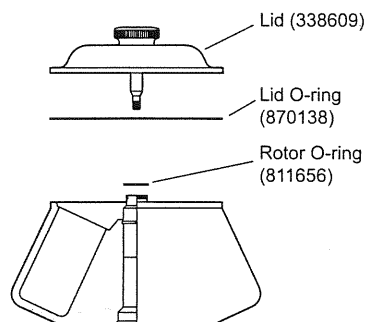
$$RCF = \frac{r\omega^2}{g}$$

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

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

## DESCRIPTION

*This rotor has been manufactured in a registered ISO 9001 or 13485 facility for use with the specified Beckman Coulter centrifuges.*



The JA-14 fixed angle rotor, rated for 14 000 rpm, is designed to centrifuge up to six 250-mL containers at a 25-degree angle to the axis of rotation. Used in Beckman Coulter J2, J6, and Avanti® J series centrifuges, the rotor develops centrifugal forces that can efficiently pellet bacterial cells from large volumes, or particles from tissue homogenates. Short column methods (such as partially filled tubes) may also be used to purify a large quantity of virus in a step gradient. Up to 1.5 liters of sample and gradient can be centrifuged per run.

The rotor body and lid are made of aluminum and are anodized for corrosion resistance—the rotor is black and the lid is blue. The lid knob secures the rotor to the drive hub.

O-rings made of Buna N rubber in the lid and rotor body maintain atmospheric pressure inside the rotor during centrifugation, if they are properly lubricated. In the event of tube or bottle leakage, small holes in the lid (over the lid O-ring) provide a temporary vent, allowing liquid to escape, thus preventing O-ring extrusion and rotor damage. Pins in the rotor drive hole mate with grooves in the centrifuge drive hub (older model centrifuges), or with drive hub teeth (new model centrifuges), to prevent the rotor from slipping during acceleration and deceleration.

The rotor has been tested<sup>1</sup> to demonstrate containment of microbiological aerosols under normal conditions of the associated Beckman Coulter centrifuge when used and maintained as instructed.

The JA-14 rotor is warranted for 7 years (see the Warranty).

## PREPARATION AND USE

*Specific information about the JA-14 rotor is given here. Use the J Series Rotors and Tubes Manual (publication JR-IM) along with this rotor manual for complete rotor and accessory operation.*

<sup>1</sup> Validation of microbiological containment was done at an independent third-party testing facility (CAMR, Porton Down, UK, or USAMRIID, Ft. Detrick, MD, U.S.A.). Improper use or maintenance may affect seal integrity and thus containment.

 **NOTE**

Although rotor components and accessories made by other manufacturers may fit in the JA-14 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.

### PRERUN SAFETY CHECKS

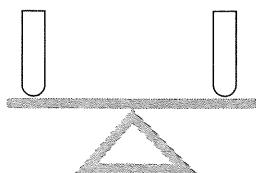


*Read the Safety Notice page at the front of this manual before using the rotor.*

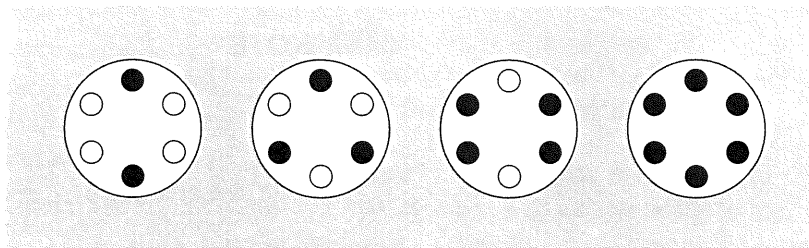
1. Make sure that the rotor and lid are clean and show no signs of corrosion or cracking.
2. Check the chemical compatibilities of all materials used (refer to Appendix A in *Rotors and Tubes*).
3. Verify that the tubes and bottles being used are listed in Table 1.

### ROTOR PREPARATION

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



1. Apply a thin film of silicone vacuum grease (335148) to the O-rings.
2. Load the filled containers symmetrically into the rotor. (Refer to TUBES AND BOTTLES on page 6 for information about containers.) If fewer than six tubes are being run, they must be arranged symmetrically in the rotor (see Figure 1). Opposing tubes must be filled to the same level with liquid of the same density (within 10 grams).



*Figure 1. Arranging Bottles or Tubes in the Rotor.  
Two, three, four, or six bottles or tubes can be run,  
if they are arranged symmetrically in the rotor, as shown.*

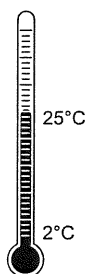
## TUBES AND BOTTLES

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The JA-14 rotor uses the tubes and bottles listed in Table 1. Be sure to use only those items listed, and to observe the maximum speed limits and fill volumes shown. (Maximum fill volume is the maximum amount that can be centrifuged in the container listed.) Refer to Appendix A in *Rotors and Tubes* for chemical compatibilities of tube, bottle, and accessory materials.

### Temperature Limits

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

### Thickwall Tubes

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Thickwall polyallomer, polypropylene, and polycarbonate tubes can be run partially filled (at least half filled) with or without caps, but all opposing tubes for a run must be filled to the same level with liquid of the same density. Do not overfill capless tubes; be sure to note the fill volumes and run speeds shown in Table 1.

Table 1. Available Tubes and Bottles for the JA-14 Fixed Angle Rotor.  
Use only the items listed here and observe fill volumes and maximum run speeds.

Tube			Max Fill Vol (mL)	Required Accessory		Max No. Tubes per Adapter	Max Speed <sup>a/</sup> RCF/ k Factor
Dimensions and Volume	Description	Part Number		Description	Part Number		
62 × 120 mm 250 mL	polypropylene wide- mouth bottle w/cap assy	356011	250	none	—		14 000 rpm 30 100 × g 1764
62 × 120 mm 250 mL	polycarbonate wide- mouth bottle w/cap assy	356013	250	none	—		14 000 rpm 30 100 × g 1764
60 × 120 mm 230 mL	conical polycarbonate bottle w/screw cap	356987	230	adapter	356983 <sup>b</sup>	1	7 500 rpm 8 600 × g —
60 × 120 mm 230 mL	conical polyallomer bottle w/ screw cap	356989	230	adapter	356983 <sup>b</sup>	1	7 500 rpm 8 600 × g —
29 × 104 mm 50 mL	polycarbonate bottle assy, liquid-tight cap assy	357000	45	adapter	356997 <sup>c</sup>	1	14 000 rpm 30 100 × g —
29 × 104 mm 50 mL	polyallomer bottle assy, liquid-tight cap assy	357001	45	adapter	356997 <sup>c</sup>	1	14 000 rpm 30 100 × g —
29 × 104 mm 50 mL	polycarbonate bottle w/screw cap	357002	40	adapter	356997 <sup>c</sup>	1	14 000 rpm 30 100 × g —
29 × 104 mm 50 mL	polyallomer bottle w/screw cap	357003	40	adapter	356997 <sup>c</sup>	1	14 000 rpm 30 100 × g —
29 × 104 mm 50 mL	polypropylene thickwall tube, snap-on cap	357005	36.5	adapter	356997 <sup>c</sup>	1	14 000 rpm 30 100 × g —
				white 29-mm cap red 29-mm cap green 29-mm cap yellow 29-mm cap blue 29-mm cap	356264 <sup>d</sup> 357359 <sup>d</sup> 357360 <sup>d</sup> 357361 <sup>d</sup> 357362 <sup>d</sup>		
29 × 104 mm 50 mL	polypropylene thickwall tube, no cap	357007	34	adapter	356997 <sup>c</sup>	1	14 000 rpm 30 100 × g —

<sup>a</sup> Maximum speeds listed are guidelines only. These speeds have been achieved in reliability tests at Beckman Coulter, but, because of manufacturing variances, no guarantee of performance or fit is expressed or implied.

<sup>b</sup> Polypropylene; package of 4.

<sup>c</sup> Polypropylene; package of 6.

<sup>d</sup> Polypropylene; package of 25.

<sup>e</sup> Polypropylene; package of 1.

<sup>f</sup> Commercially available. Observe manufacturer's speed and fill volume guidelines.

<sup>g</sup> Delrin; package of 1. Delrin is a registered trademark of E.I. Du Pont de Nemours & Company.

— Continued

Table 1. Available Tubes and Bottles for the JA-14 Fixed Angle Rotor (continued).

Tube			Max Fill Vol (mL)	Required Accessory		Max. No. Tubes per Adapter	Max Speed <sup>a</sup> / RCF/ k Factor
Dimensions and Volume	Description	Part Number		Description	Part Number		
29 × 104 mm 50 mL	polyallomer bottle assy w/snap-on cap	361694	50	adapter	356997	1	14 000 rpm 30 100 × g —
29 × 104 mm 50 mL	polycarbonate open-top tube	363647	50	adapter	356997	1	14 000 rpm 30 100 × g —
29 × 104 mm 50 mL	polycarbonate tube w/snap-on cap	363664	36.5	adapter	356997	1	14 000 rpm 30 100 × g —
29 × 104 mm 50 mL	conical	f	50	adapter	356966	1	14 000 rpm 30 100 × g —
17 × 120 mm 15 mL	conical	f	15	adapter	356964 <sup>d</sup>	4	9 000 rpm 8 000 × g —
14 × 55 mm 4 mL	Biovials	566353	4	adapter	342098 <sup>g</sup>	9	14 000 rpm 20 000 × g —

<sup>a</sup> Maximum speeds listed are guidelines only. These speeds have been achieved in reliability tests at Beckman Coulter, but, because of manufacturing variances, no guarantee of performance or fit is expressed or implied.

<sup>b</sup> Polypropylene; package of 4.

<sup>c</sup> Polypropylene; package of 6.

<sup>d</sup> Polypropylene; package of 25.

<sup>e</sup> Polypropylene; package of 1.

<sup>f</sup> Commercially available. Observe manufacturer's speed and fill volume guidelines.

<sup>g</sup> Delrin; package of 1. Delrin is a registered trademark of E.I. Du Pont de Nemours & Company.



### Polycarbonate and Polyallomer Bottles

Capped polycarbonate and polyallomer bottles may be run completely filled, or partially filled (not less than half full). All opposing containers for a run must be filled to the same level. Be sure to note the reductions in run speed shown in Table 1 if bottles are partially filled.

## OPERATION

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ROTOR ID

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**JA-14**

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- Precool the rotor in the centrifuge or in a refrigerator before use—especially before short runs—to ensure that the rotor reaches the set temperature. A suggested precooling cycle is a minimum of 30 minutes at 2000 rpm at the required temperature.
- If fluid containment is required, *use capped tubes or bottles*. It is strongly recommended that all containers carrying physiological fluids be capped to prevent leakage.
- If you are using an Avanti J series centrifuge, select the JA-14 rotor. If you are using an Avanti J-E or a microprocessor-controlled J2 or J6 series centrifuge, enter rotor code **14**.
- In Avanti J series centrifuges (except J-E), the rotor identification system can misidentify the JA-14 rotor as a JA-12 during rotor acceleration. If misidentification occurs, the centrifuge limits the rotor speed to 12 000 rpm. (If you had set the speed to 14 000 rpm, the centrifuge would automatically reduce the speed to 12 000 rpm.) A Beckman Coulter Field Service representative can recalibrate the Avanti J centrifuge to prevent misidentification of the JA-14 rotor. Call your Beckman Coulter Field Service representative to schedule a service call.
- *J2 and J6 series centrifuges only*. Apply a thin film of Spinkote™ lubricant to the centrifuge drive hub and to the metal threads on the lid knob.

## INSTALLING THE ROTOR

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Two metal pins inside the rotor drive hole engage with teeth on the centrifuge drive spindle hub to prevent the rotor from slipping during acceleration and deceleration (see Figure 2). When the rotor is properly installed, the pins sit either in the drive hub grooves or on top of the hub surface (see Figure 3).



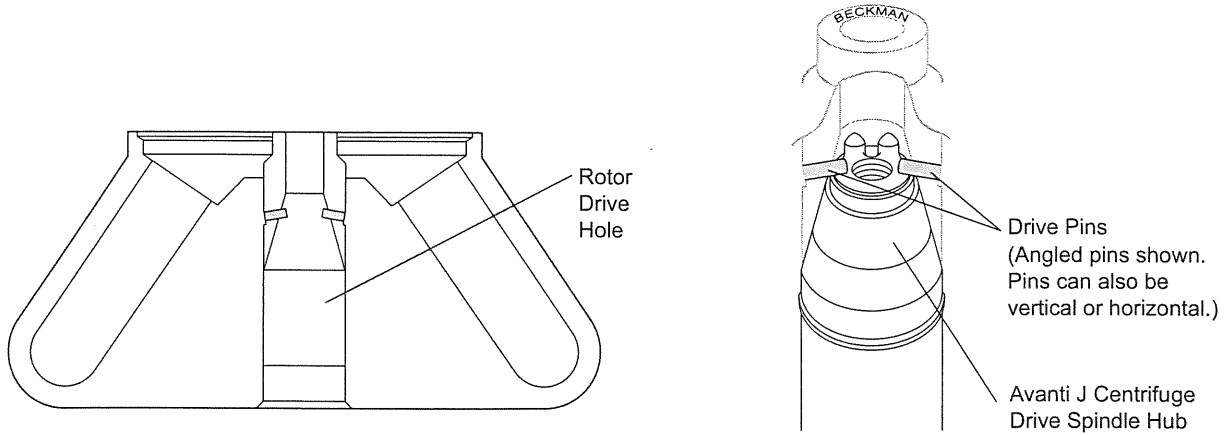


Figure 2. Rotor Drive Pin Location and Orientation

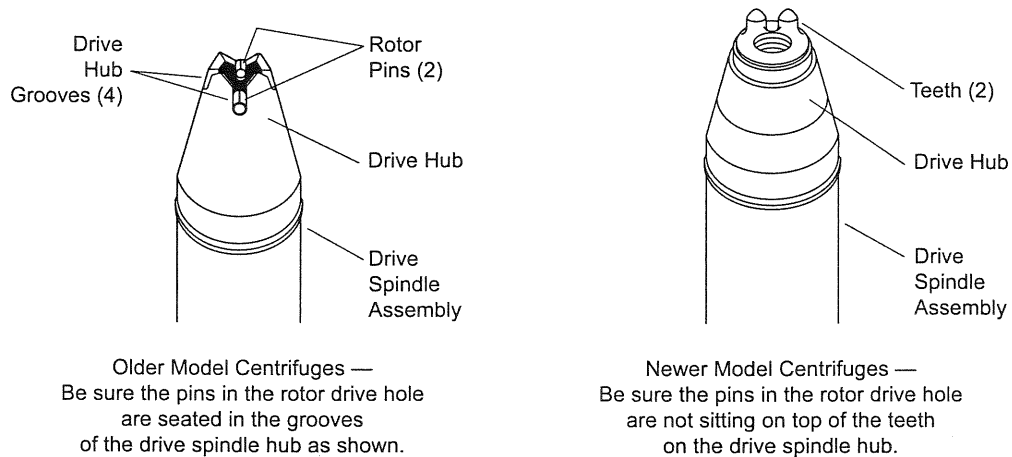


Figure 3. Centrifuge Drive Spindle Hub Configurations

The rotor pins are positioned parallel to the BECKMAN name engraved at the center of the rotor body (see Figure 4). Knowing the pin orientation before you install the rotor will help to ensure that you position the rotor properly on the hub, minimizing the chance of hub damage. Follow the steps below.

1. Turn the rotor until the BECKMAN name is either horizontal or perpendicular to the drive hub pins or teeth (see Figure 4). Alternately, rotate the drive spindle to align the hub pins or teeth with the rotor drive pins.

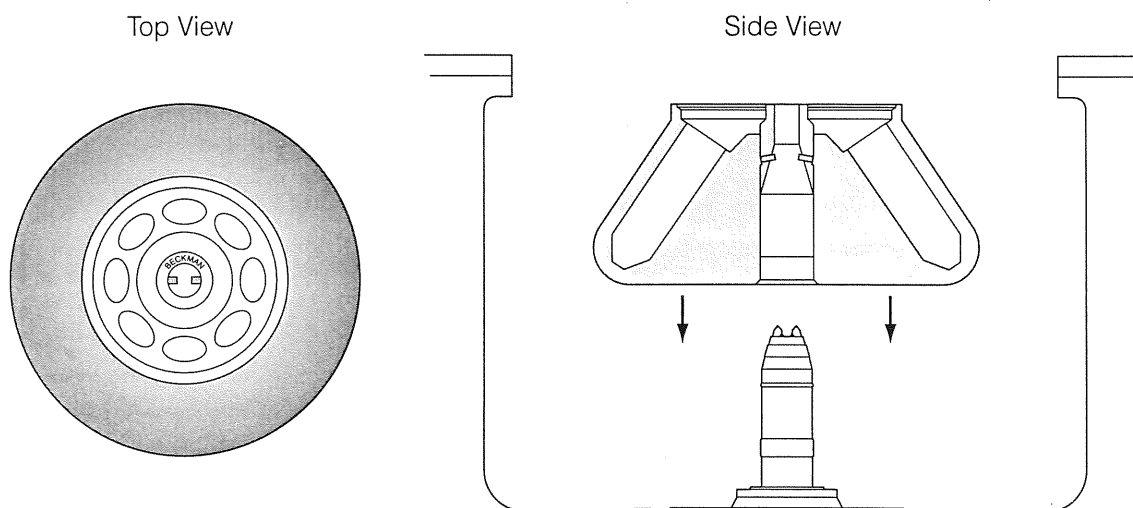


Figure 4. Installing the Rotor

2. Carefully lower the rotor straight down onto the centrifuge drive spindle hub. Do not drop the rotor onto the hub.
3. Slowly turn the rotor, making sure that it is properly seated on the drive spindle hub. (In rare cases, the rotor pins can rest on top of the hub pins or teeth and not seat on the hub surface. This can prevent the rotor from being secured to the drive spindle. Turning the rotor slightly after installing it will move the pins into proper position.)
4. To secure the rotor to the drive spindle, place the lid on the rotor and turn the lid knob to the right (clockwise) until secure. Do not overtighten.

## REMOVAL AND SAMPLE RECOVERY

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### 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.*

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1. Unscrew the rotor lid to release the rotor from the spindle hub.
2. Remove the rotor by lifting it straight up and off the drive spindle. If the rotor sticks to the drive spindle, a collar adapter (338689) and rotor removal tool (346965) may be used.
  - a. Remove the lid and small O-ring from the rotor.
  - b. Slide the flanges of the collar into the empty O-ring groove.
  - c. Screw the larger end of the rotor removal tool into the threaded opening of the collar adapter. As the removal tool tightens down, it will push against the drive spindle, causing the rotor to rise.
  - d. Remove the tool and collar adapter from the rotor by reversing the above procedure.
  - e. Replace the O-ring in the groove.
  - f. Remove the rotor from the centrifuge.

## TEMPERATURE

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TEMP °C

4

To ensure that the JA-14 rotor reaches the required temperature during the run, follow the appropriate instructions below for the model of J centrifuge being used.

### Avanti J Series Centrifuges

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Enter the run temperature according to the instructions in your centrifuge instruction manual. No additional input is required.

### Microprocessor-Controlled J2 and J6 Series Centrifuges (Models J2-MI, J6-MI, J2-MC, and J6-MC)

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Enter rotor code **14**, then follow the steps below.

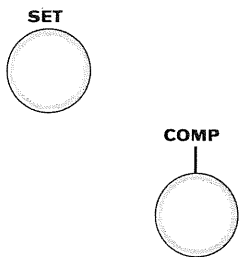
1. Press the [TEMP] key on the centrifuge control panel and then use the keypad to enter the sample temperature.

2. Find the compensation value in Table 2 that corresponds with the set temperature and run speed. The compensation values listed in Table 2 are approximates for all centrifuge models. If precise temperature control is required, determine the compensation settings empirically as follows:
  - a. Fill the rotor with water-filled tubes or bottles. Precool the rotor and water to the required temperature.
  - b. Place the filled, precooled rotor in the centrifuge and run the system for at least 1/2 hour.
  - c. Measure the water temperature. If it is lower than the required run temperature, enter positive compensation units during run setup following steps 3 and 4 below. If it is higher than the required run temperature, enter negative compensation units during run setup, also using steps 3 and 4, below.
  - d. Discard the water. Fill tubes with sample, load tubes into the rotor, and precool the system to the required temperature before starting the run.
3. Press [**COMP ADJ**]. the word “COMP” flashes below the TEMPERATURE display and the display flashes.
4. Use the keypad to enter the desired compensation value. Press the [**± .**] key to enter a minus sign; pressing it again will remove the minus sign.
5. Check the temperature display. (If the entry is incorrect, press [**CE**] and reenter the digits.)
6. When the entry is correct, press [**ENTER/RECALL**].

 **NOTE**

To clear a COMP ADJ entry, press [**COMP ADJ**], [**0**], and [**ENTER/RECALL**].

### Analog J2 Series Centrifuges



Enter the required run temperature and the appropriate temperature compensation units (see Table 2) on the centrifuge control panel as follows.

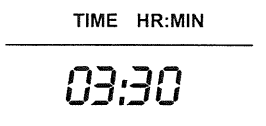
1. Turn the SET knob to the required sample temperature.
2. Find the compensation value that corresponds to the required temperature and run speed. The compensation values listed in Table 2 are approximate for all centrifuge models. If precise temperature control is required, follow the steps in **Microprocessor-Controlled J2 and J6 Series Centrifuges**, above.

Table 2. Centrifuge Temperature Compensation Settings

Rotor Speed (rpm)	Required Sample Temperature (°C)						
	-20°	-10°	2°	5°	10°	20°	40°
14 000	N	N	-7	-7	-7	-5	-4
12 000	N	-6	-5	-5	-4	-3	-2
10 000	-4	-4	-3	-3	-2	-1	N
5 000	-4	0	0	0	0	0	N

An "N" indicates that the rotor cannot achieve the required temperature at this speed.

### RUN TIMES



The *k* factor of the rotor is a measure of the rotor's pelleting efficiency. Beckman Coulter has calculated the *k* factors for all of its rotors, at maximum speed with full tubes, using the following formula:

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

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

After substitution:

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

In the JA-14 rotor, the  $k$  factor is 1764 for full 250-mL bottles at maximum speed. For containers that nominally hold less than 250 mL, the  $k$  factors will be different. Calculate the  $k$  factors for these containers using equation (2).

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

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

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

$$k_{\text{adj}} = k \left( \frac{14\,000}{\text{actual run speed}} \right)^2 \quad (4)$$

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

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

where the  $k$  factors have been adjusted for the actual run speed used.

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

## RUN SPEEDS

SPEED RPM/RCF  


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**14 000 RPM**  


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The centrifugal force at a given radius in a rotor is a function of speed. Comparisons of forces between different rotors are made by comparing the rotors' relative centrifugal fields (RCF). When rotational speed is adjusted so that identical samples are subjected to the same rcf in two different rotors, the samples are subjected to the same force. The RCF at a number of rotor speeds is provided in Table 3.

**Do not select rotational speeds higher than the maximums you have determined to be appropriate for your protocols (in no case above 14 000 rpm or the limit shown in Table 1).** In addition, when centrifuging solutions more dense than 1.2 g/mL in this rotor, calculate the reduced maximum allowable rotor speed:

$$\text{reduced maximum speed} = (14\,000 \text{ rpm}) \sqrt{\frac{1.2 \text{ g/mL}}{\text{density of tube contents}}} \quad (6)$$

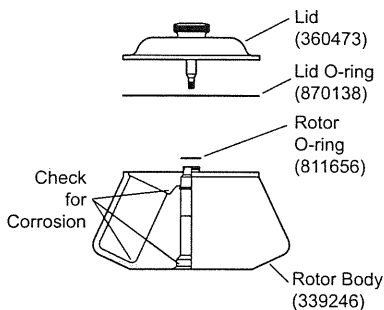
*Note, however, that the use of this formula may still produce maximum speed figures higher than the limitations imposed by the use of certain tubes or adapters (see Table 1). In such cases, use the lower of the two figures.*

## CARE AND MAINTENANCE

### MAINTENANCE

#### NOTE

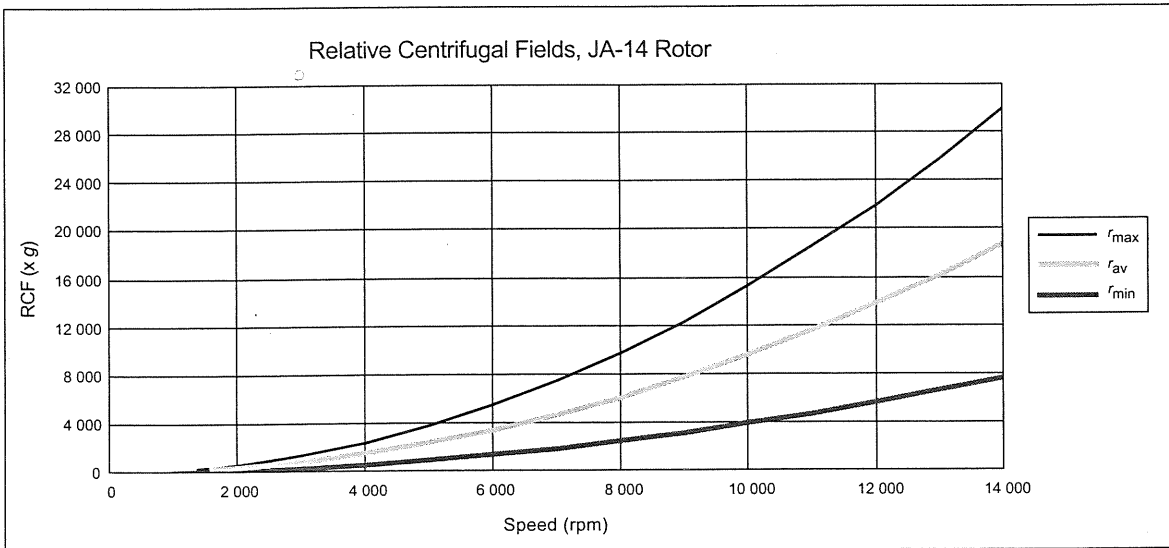
Do not use sharp tools on the rotor that could cause scratches in the rotor surface. Corrosion begins in scratches and may open fissures in the rotor with continued use.



- Periodically (at least monthly) inspect the rotor, especially inside cavities, for rough spots or pitting, white powder deposits (frequently aluminum oxide), or heavy discoloration. If any of these signs are evident, do not run the rotor. Contact your Beckman Coulter representative for information about the Field Rotor Inspection Program and the rotor repair center.

Table 3. Relative Centrifugal Fields for the JA-14 Rotor.  
 Entries in this table are calculated from the formula  
 $RCF = 1.12 r (RPM/1000)^2$   
 and then rounded to three significant digits.

Rotor Speed (rpm)	Relative Centrifugal Field (× g)		
	At $r_{max}$ (137 mm)	At $r_{av}$ (86 mm)	At $r_{min}$ (35 mm)
14 000	30 100	18 900	7 680
13 000	25 900	16 300	6 620
12 000	22 100	13 900	5 640
11 000	18 600	11 700	4 740
10 000	15 300	9 630	3 920
9 000	12 400	7 800	3 180
8 000	9 820	6 160	2 510
7 000	7 520	4 720	1 920
6 000	5 520	3 470	1 410
5 000	3 840	2 410	980
4 000	2 460	1 540	627
3 000	1 380	866	352
2 000	613	385	156
1 000	153	96	39





- Before using the rotor, inspect the rotor drive pins to ensure that they are not damaged. Damaged drive pins can prevent the rotor from seating properly on the centrifuge drive hub (Avanti J series centrifuges only). To inspect the drive pins, turn the rotor upside down and look into the drive hold in the center of the rotor. If the drive pins appear damaged, contact Beckman Coulter Field Service
- Regularly lubricate the metal threads in the rotor with a thin, even coat of Spinkote lubricant (306812). Failure to keep these threads lubricated can result in damaged threads.
- Regularly apply silicone vacuum grease (335148) to the O-rings. Replace O-rings about twice a year or whenever worn or damaged.
- Routinely apply Spinkote lubricant (306812) to the centrifuge drive spindle to prevent the rotor from sticking (not required on Avanti J series centrifuges).

Refer to Appendix A in *Rotors and Tubes* for chemical compatibilities of rotor and accessory materials. Your Beckman Coulter representative provides contact with the Field Rotor Inspection Program and the rotor repair center.

## CLEANING

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*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.*



Rotor Cleaning Kit (339558)

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

1. Remove the O-rings before washing.
2. Wash the rotor and lid in a mild detergent, such as Beckman Solution 555™ (339555), that won't damage the rotor. 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 rotor components in a dishwasher.  
Do not soak in detergent solution for long periods, such as overnight.

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## SUPPLY LIST

### 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.

Contact Beckman Coulter Sales (1-800-742-2345 in the United States) or your local Beckman Coulter office, or see the *Beckman Coulter High Performance, High Speed, High Capacity Rotors, Tubes, and Accessories* catalog (BR-8102, available at [www.beckmancoulter.com](http://www.beckmancoulter.com)) for detailed information on ordering parts and supplies. For your convenience, a partial list is given below.

### REPLACEMENT ROTOR PARTS

JA-14 rotor assembly . . . . .	339247
Rotor lid assembly. . . . .	360473
Spring pin for rotor lid . . . . .	870137
Lid O-ring (large) . . . . .	870138
Rotor O-ring (small) . . . . .	811656
Rotor tie-down kit . . . . .	364912

### OTHER

Tubes, bottles, and accessories . . . . .	see Table 1
Spinkote lubricant (2 oz). . . . .	306812
Silicone vacuum grease (1 oz) . . . . .	335148
Rotor Cleaning Kit . . . . .	339558
Beckman Solution 555 (1 qt) . . . . .	339555
Rotor cleaning brush . . . . .	339379
Rotor removal tool . . . . .	346965
Collar adapter . . . . .	338689