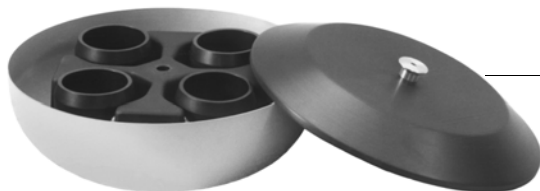


Instructions for Using JS-5.2 and JS-4.0 Swinging Bucket Rotors



JS-5.2

Used in Beckman Coulter J6 Series Centrifuges



JS-4.0

**Used in Beckman Coulter
Avanti® J-26XP Series
and J6 Series Centrifuges**



SAFETY NOTICE

This safety notice summarizes information basic to the safe use of the equipment described in this publication. 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 of 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 system. 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 such fluids are free of micro-organisms. Some of the most virulent—Hepatitis (B and C) viruses, HIV (I–V), atypical mycobacteria, and certain systemic fungi—further emphasize the need for aerosol protection. Handle other infectious samples according to good laboratory procedures and methods to prevent spread of disease. Because spills may generate aerosols, observe proper safety precautions for aerosol containment. Do not run toxic, pathogenic, or radioactive materials in this rotor without taking appropriate safety precautions. Biosafe containment should be used when Risk Group II materials (as identified in the World Health Organization *Laboratory Biosafety Manual*) are handled; materials of a higher group require more than one level of protection.



Dispose of all waste solutions according to appropriate environmental health and safety guidelines.



The rotors and accessories are not designed for use with materials capable of developing flammable or explosive vapors. Do not centrifuge such materials (such as chloroform or ethyl alcohol) in or handle or store them near the centrifuge.



Components or accessories designed for other rotors may cause rotor mishap if used in these rotors. Use only components and accessories that have been designed for use in these rotors. *The safety of rotor components and accessories made by other manufacturers cannot be ascertained by Beckman Coulter. Use of other manufacturers' components or accessories in the rotors may void the rotor warranty and should be prohibited by your laboratory safety officer.* If tubes, microplates, or other labware made by manufacturers other than Beckman Coulter are used, reduce rotor speed to prevent breakage. The strength of glass and plastic tubes can vary between lots, and will depend on handling and usage; we highly recommend that you pretest labware in the rotor using water samples to determine optimal operating conditions. Scratches (even microscopic ones) significantly weaken glass tubes.



All four positions on the rotor yoke must contain either a bucket or a carrier (loaded or unloaded) during a run. Never run the rotor without all of the positions being filled.



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



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

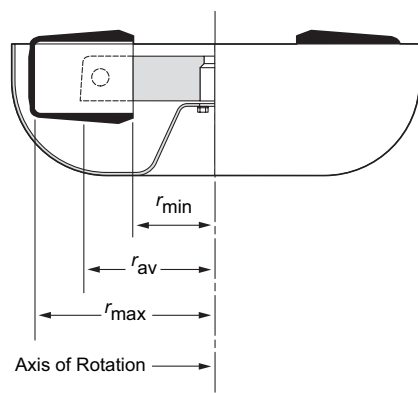
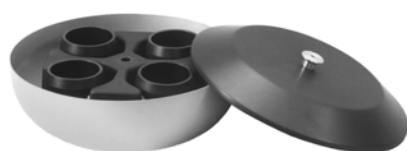


Do not use sharp tools on the rotor that could cause scratches in the rotor surface. Corrosion begins in scratches and may open fissures in the rotor with continued use.

JS-5.2

NOTE

The JS-5.2 rotor is used in Beckman Coulter J6 series centrifuges only. It *cannot* be used in Avanti J series centrifuges.



SPECIFICATIONS

Maximum speed	5200 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} (226 mm)	$6840 \times g$
At r_{av} (156 mm)	$4720 \times g$
At r_{\min} (86 mm)	$2600 \times g$
Number of buckets	4
Nominal capacity per bucket	1 liter bottle, or 1 quad pack blood bag
Nominal capacity of rotor	4 liters, 4 blood bags, 12 microplates, 148 RIA tubes
Approximate acceleration time to maximum speed (rotor fully loaded)	2 1/2 min
Approximate deceleration time from maximum speed (rotor fully loaded)	3 min
Weight of fully loaded rotor	21 kg (46 lb)
Rotor and bucket material	anodized aluminum
Conditions requiring speed reduction	see RUN SPEEDS
Rotor entry code for microprocessor-controlled instruments	5.2

* 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:

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

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:

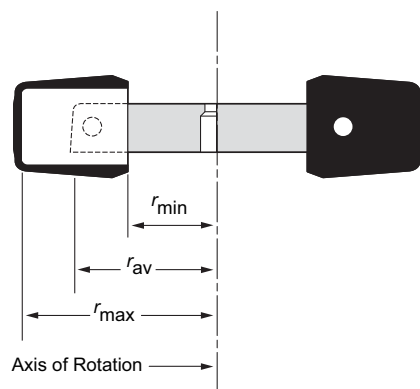
$$\text{RCF} = 1.12 r \left(\frac{\text{RPM}}{1000} \right)^2$$

U.S. Pat. No. 4,009,824
U.S. Pat. No. 4,010,890
Canadian Pat. No. 1,063,989
French Pat. No. 77 00732
Japanese Util. Mod. No. U.M. 1,462,551

JS-4.0

NOTE

The JS-4.0 rotor can be used in Beckman Coulter Avanti® J-26XP series, discontinued Avanti J-20 series, and J6 series centrifuges.



SPECIFICATIONS

Maximum speed	4000 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} (226 mm)	$4050 \times g$
At r_{av} (156 mm)	$2800 \times g$
At r_{\min} (86 mm)	$1540 \times g$
Number of buckets	4
Nominal capacity per bucket	1 liter bottle, or 1 quad-pack blood bag
Nominal capacity of rotor	4 liters, 4 blood bags, 12 microplates, 148 RIA tubes
Approximate acceleration time to maximum speed (rotor fully loaded)	2 min
Approximate deceleration time from maximum speed (rotor fully loaded)	1 1/2 min
Weight of fully loaded rotor	17 kg (37 lb)
Rotor and bucket material	anodized aluminum
Conditions requiring speed reduction	see RUN SPEEDS
Rotor entry code for microprocessor-controlled instruments	4.0

* 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:

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

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:

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

U.S. Pat. No. 4,009,824

DESCRIPTION

These rotors have been manufactured in a registered ISO 9001 or 13485 facility for use with the specified Beckman Coulter centrifuges.

ROTORS

The JS-5.2 and JS-4.0 swinging bucket rotors are rated for maximum speeds of 5200 and 4000 rpm, respectively. These rotors share a common four-place rotor yoke; the JS-5.2 has a windshield around the yoke and buckets, and the JS-4.0 has no windshield. Each rotor holds four buckets or four microplate carriers that hook over stainless steel pins set in the yoke and swing out to horizontal position during centrifugation. The buckets hold a wide variety of sample containers, including tubes, bottles, and blood bag cups. The microplate carriers are used to perform serial dilution of small liquid volumes.

Rotor assemblies, buckets, and lids are made of anodized aluminum. The rotors are each warranted for 7 years (see the Warranty at the back of this manual).

PREPARATION AND USE

Specific information about the JS-5.2 and JS-4.0 rotors is given here. Use the J Series Rotors and Tubes Manual (publication JR-IM) along with this rotor manual for complete rotor and accessory information.



CAUTION

Although rotor components and accessories made by other manufacturers may fit in the JS-5.2 and JS-4.0 rotors, their safety in these rotors cannot be ascertained by Beckman Coulter. Use of other manufacturers' components or accessories in these rotors may void the rotor warranty and should be prohibited by your laboratory safety officer. Only the components listed in this publication should be used in these rotors.

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, if applicable, 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, bottles, and other labware being used are listed in Tables 1 through 4.

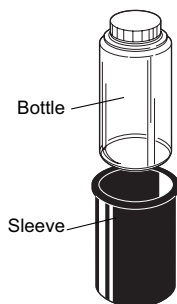
ROTOR PREPARATION

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

- Before installing the rotor, lightly coat the centrifuge drive hub with Spinkote™ lubricant (306812).
- Load the filled containers symmetrically into the rotor. If you are running two containers, place containers opposite each other on the yoke and place empty buckets in the other positions. Opposing containers must be filled to the same level with liquid of the same density.

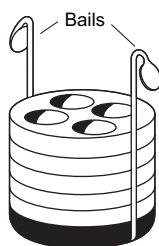
BUCKETS AND ACCESSORIES

The round buckets used in the JS-5.2 and JS-4.0 rotors can hold bottle adapters, Multi-Disc™ adapters to accommodate tubes of various sizes, and blood bag cups.



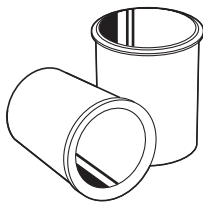
Bottle Sleeve

The one-liter bottles used in the JS-5.2 and JS-4.0 rotors are supported in a polypropylene sleeve (356096) that fits inside the buckets. Bottles available for use are listed in Table 1.



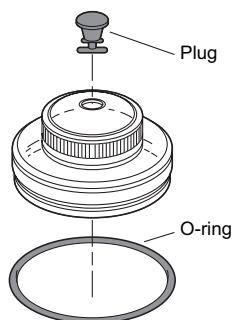
Multi-Disc Adapters

The Multi-Disc adapters are made up of polypropylene discs, which are stacked and snapped together to accommodate a particular size bottle or tube. The number of adapters required depends on the length of the tube or bottle. The discs are color-coded for identification. See Table 2 for the appropriate adapter discs for use with different size tubes and bottles.



Blood Bag Cups

Polypropylene cups provide support for blood bags in the rotor buckets. A single or double pack blood bag cup, and a triple or quad pack cup, are available and are listed in Table 3.



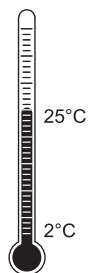
Aeroseal™ Covers for Buckets

The Aeroseal™ covers¹ (343686) are designed to minimize leakage of aerosol particles from buckets during centrifugation. Aeroseal covers can be used with Multi-Disc adapters (with modified bracket 343369) but not with blood bag cups. For more information, refer to publication J6-TB-017, which is shipped with the covers.

¹ U.S. Pat. No. 4,342,419.

TUBES AND BOTTLES

The JS-5.2 and JS-4.0 rotors use 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. Refer to Appendix A in *Rotors and Tubes* for chemical compatibilities of tube, bottle, and accessory materials.



Temperature Limits

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

Thickwall Tubes



Thickwall polyallomer, polypropylene, and polycarbonate tubes can be run partially 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.



Polycarbonate and Polyallomer Bottles

Capped polycarbonate and polyallomer bottles may be run completely filled, or partially filled. All opposing containers for a run must be filled to the same level.

*Table 1. Available Tubes and Bottles for the JS-5.2 and JS-4.0 Swinging Bucket Rotors.
Use only the items listed here and observe fill volumes and maximum run speeds.*

Tube			Max Fill Vol ^a (mL)	Required Accessory		Max Speed ^b
Dimensions and Volume	Description	Part Number		Description	Part Number	
97 × 167 mm 1000 mL	polycarbonate bottle w/screw cap	355675 (pkg/6)	1000	sleeve	356096	5 200 rpm
97 × 167 mm 1000 mL	polypropylene bottle w/screw cap	355676 (pkg/6)	1000	sleeve	356096	5 200 rpm
96 × 130 mm 750 mL	polycarbonate bottle w/screw cap	358299 (pkg/6)	750	sleeve	356096	5 200 rpm
96 × 130 mm 750 mL	polypropylene bottle w/screw cap	356855 (pkg/6)	750	sleeve	356096	5 200 rpm
69 × 160 mm 500 mL	polycarbonate bottle w/screw cap	355664 (pkg/6)	500	adapter	339109	5 200 rpm
69 × 160 mm 500 mL	polycarbonate wide- mouth bottle w/cap assy	355605 (pkg/6)	500	adapter	339109	5 200 rpm
69 × 160 mm 500 mL	polypropylene wide- mouth bottle w/cap assy	355607 (pkg/6)	500	adapter	339109	5 200 rpm
69 × 160 mm 500 mL	polycarbonate bottle, no cap	355649 (pkg/6)	500	adapter	339109	5 200 rpm
69 × 159 mm 500 mL	polypropylene bottle w/screw cap	355665 (pkg/6)	500	adapter	339109	5 200 rpm
69 × 159 mm 500 mL	polypropylene bottle, no cap	355650 (pkg/6)	500	adapter	339109	5 200 rpm
62 × 136 mm 250 mL	polycarbonate round- bottom bottle w/screw cap	355673 (pkg/6)	250	adapter	339108	5 200 rpm
62 × 122 mm 250 mL	polycarbonate wide- mouth bottle	358275 (pkg/6)	250	adapter	339108	5 200 rpm
62 × 122 mm 250 mL	polypropylene wide- mouth bottle	358326 (pkg/6)	250	adapter	339108	5 200 rpm

^a Above 20°C fill polypropylene tubes at least half full.

Continued—

^b Maximum speeds listed are for the JS-5.2 rotor, and 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. The maximum speed of all tubes and bottles in the JS-4.0 rotor is 4000 rpm.

^c Package of 25.

^d To order caps for 15-mL tubes 342080, 342081, and 342082, use part number 343656 for a package of 50. Caps 343656 are made of Hytrel thermoplastic polyester elastomer. Hytrel is a registered trademark of E.I. Du Pont de Nemours & Co. Note that Hytrel does not provide the same chemical resistance as the tube materials. Before using the caps, check with the manufacturer to verify Hytrel's ability to withstand exposure to the chemicals you will be using.

Table 1. Available Tubes and Bottles for the JS-5.2 and JS-4.0 Swinging Bucket Rotors (continued)

Tube			Max Fill Vol ^a (mL)	Required Accessory		Max Speed ^b
Dimensions and Volume	Description	Part Number		Description	Part Number	
62 × 120 mm 250 mL	polypropylene wide mouth bottle w/cap assy	356011 (pkg/6)	250	none	—	5 200 rpm
62 × 120 mm 250 mL	polycarbonate wide mouth bottle w/cap assy	356013 (pkg/6)	250	none	—	5 200 rpm
60 × 120 mm 230 mL	conical polycarbonate bottle w/screw cap	356987 (pkg/6)	230	adapter	356983/ 339108	5 200 rpm
60 × 120 mm 230 mL	conical polyallomer bottle w/screw cap	356989 (pkg/6)	230	adapter	356983	5 200 rpm
38 × 102 mm 100 mL	polypropylene bottle, no cap	355626 (pkg/6)	100	adapter	339104	5 200 rpm
38 × 102 mm 100 mL	polypropylene bottle w/cap	355624 (pkg/6)	100	adapter	339104	5 200 rpm
38 × 102 mm 70 mL	polycarbonate bottle w/cap assy	355620 (pkg/6)	70	adapter	339104	5 200 rpm
38 × 102 mm 70 mL	polycarbonate bottle, no cap	355655 (pkg/6)	70	adapter	339104	5 200 rpm
29 × 104 mm 50 mL	polyallomer bottle assy w/snap-on cap	361694 (pkg/24)	50	adapter	356997	5 200 rpm
29 × 104 mm 50 mL	polycarbonate open-top tube	363647 (pkg/25)	50	adapter	356997	5 200 rpm
29 × 104 mm 50 mL	polycarbonate bottle assy, liquid-tight cap assy	357000 (pkg/6)	45	none	—	5 200 rpm
29 × 104 mm 50 mL	polyallomer bottle assy, liquid-tight cap assy	357001 (pkg/6)	45	none	—	5 200 rpm
29 × 104 mm 50 mL	polycarbonate bottle w/screw cap	357002 (pkg/25)	40	none	—	5 200 rpm

^a Above 20°C fill polypropylene tubes at least half full.

Continued—

^b Maximum speeds listed are for the JS-5.2 rotor, and 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. The maximum speed of all tubes and bottles in the JS-4.0 rotor is 4000 rpm.^c Package of 25.^d To order caps for 15-mL tubes 342080, 342081, and 342082, use part number 343656 for a package of 50. Caps 343656 are made of Hytrel thermoplastic polyester elastomer. Hytrel is a registered trademark of E.I. Du Pont de Nemours & Co. Note that Hytrel does not provide the same chemical resistance as the tube materials. Before using the caps, check with the manufacturer to verify Hytrel's ability to withstand exposure to the chemicals you will be using.

Table 1. Available Tubes and Bottles for the JS-5.2 and JS-4.0 Swinging Bucket Rotors (continued)

Tube			Max Fill Vol ^a (mL)	Required Accessory		Max Speed ^b
Dimensions and Volume	Description	Part Number		Description	Part Number	
29 × 104 mm 50 mL	polyallomer bottle w/screw cap	357003 (pkg/25)	40	none	—	5 200 rpm
29 × 104 mm 50 mL	polycarbonate tube w/snap-on cap	363664 (pkg/25)	36.5	adapter	356997	5 200 rpm
29 × 104 mm 50 mL	polypropylene thick-wall tube, snap-on cap	357005 (pkg/25)	36.5	white 29-mm cap red 29-mm cap green 29-mm cap yellow 29-mm cap blue 29-mm cap	356264 ^c 357359 ^c 357360 ^c 357361 ^c 357362 ^c	5 200 rpm
29 × 104 mm 50 mL	polypropylene thick-wall tube, no cap	357007 (pkg/25)	34	none	—	5 200 rpm
18 × 98 mm 15 mL	polyethylene tube, open top	342081 ^d (pkg/100)	15	adapter	339102	5 200 rpm
18 × 98 mm 15 mL	polycarbonate tube, open top	342080 ^d (pkg/100)	15	adapter	339102	5 200 rpm
18 × 100 mm 15 mL	polypropylene tube, open top	342082 ^d (pkg/100)	15	adapter	339102	5 200 rpm
17 × 119 mm 15 mL	conical polypropylene open-top tube	355663 (pkg/6)	15	adapter	356995	5 200 rpm
16 × 80 mm 10 mL	polycarbonate bottle w/cap	355672 (pkg/25)	10	adapter	341977	5 200 rpm
16 × 76 mm 10 mL	stainless steel tube, open-top	301108 (pkg/1)	10	adapter	341977	5 200 rpm
16 × 76 mm 10 mL	polycarbonate tube, open-top	355630 (pkg/25)	10	adapter	341977	5 200 rpm
16 × 76 mm 10 mL	polyallomer tube, open-top	355640 (pkg/25)	10	adapter	341977	5 200 rpm

^a Above 20°C fill polypropylene tubes at least half full.

Continued—

^b Maximum speeds listed are for the JS-5.2 rotor, and 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. The maximum speed of all tubes and bottles in the JS-4.0 rotor is 4000 rpm.^c Package of 25.^d To order caps for 15-mL tubes 342080, 342081, and 342082, use part number 343656 for a package of 50. Caps 343656 are made of Hytrel thermoplastic polyester elastomer. Hytrel is a registered trademark of E.I. Du Pont de Nemours & Co. Note that Hytrel does not provide the same chemical resistance as the tube materials. Before using the caps, check with the manufacturer to verify Hytrel's ability to withstand exposure to the chemicals you will be using.

Table 1. Available Tubes and Bottles for the JS-5.2 and JS-4.0 Swinging Bucket Rotors (continued)

Tube			Max Fill Vol ^a (mL)	Required Accessory		Max Speed ^b
Dimensions and Volume	Description	Part Number		Description	Part Number	
14 × 55 mm 4 mL	polypropylene Bio-vial	566353 (pkg/1000)	4	adapter	339101	5 200 rpm
11 × 39 mm 1.5 mL	polyallomer tube w/snap-on cap	357448 (pkg/500)	1.5	adapters	339100/ 354511	5 200 rpm
11 × 39 mm 1.5 mL	polypropylene tube w/snap-on cap	343169 (pkg/500)	1.5	adapters	339100/ 354511	5 200 rpm
11 × 39 mm 1.5 mL	polyethylene tube w/snap-on cap	340196 (pkg/500)	1.5	adapters	339100/ 354511	5 200 rpm

^a Above 20°C fill polypropylene tubes at least half full.

^b Maximum speeds listed are for the JS-5.2 rotor, and 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. The maximum speed of all tubes and bottles in the JS-4.0 rotor is 4000 rpm.

^c Package of 25.

^d To order caps for 15-mL tubes 342080, 342081, and 342082, use part number 343656 for a package of 50. Caps 343656 are made of Hytrel thermoplastic polyester elastomer. Hytrel is a registered trademark of E.I. Du Pont de Nemours & Co. Note that Hytrel does not provide the same chemical resistance as the tube materials. Before using the caps, check with the manufacturer to verify Hytrel's ability to withstand exposure to the chemicals you will be using.

Table 2. Multi-Disc Adapters Used with Tubes and Bottles

Typical Tube/Bottle Sizes Used	Max Tube Dimensions ^a		Number of Tubes per Adapter	Number of Tubes per Rotor	Adapter Part Number	Color
	Diameter	Length				
3 and 5 mL	12 mm	133 mm	37	148	339100	blue
10 mL	14 mm	133 mm	24	96	339101	orange
12 mL	16 mm	133 mm	19	76	341977	purple
20 mL	18 mm	133 mm	14	56	339102 ^b	green
50 mL	28 mm	136 mm	7	28	339103	yellow
50 mL (conical)	30 mm	136 mm	4	16	345386	lt. green
50 mL	35 mm	136 mm	4	16	341794	dark blue
100 mL	44 mm	165 mm	2	8	339104	brown
230 mL (conical)	62 mm	141 mm	1	4	339108	red
250 mL	62 mm	160 mm	1	4	339108	red
500 mL	70 mm	160 mm	1	4	339109	yellow
Double-Stacking Adapter ^c						
3 and 5 mL	12 mm	75 mm	19	76	339119	blue/white

^a Additional discs can be added.

^b This adapter also holds 15-mL conical tubes.

^c To run 148 RIA tubes, use four of the 37-hole adapters (339100) plus four of the 19-hole adapters (339119). Tube retaining device 343108 is required; use of this device is described in publication IN-174, which ships with 343108.

Table 3. Blood Bag Cups

Description	Blood Packs per Cup	Number of Cups per Rotor	Part Number (set of 2)
Blood bag cups (yellow) 88 mm inside diameter	1 single or double pack	4	339127
Blood bag cups (red) 98 mm inside diameter	1 triple or quad pack	4	339129

Stainless Steel Tubes



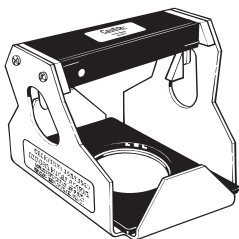
Stainless steel tubes offer excellent resistance to organic solvents and heat, but should not be used with most acids or bases. They offer only marginal resistance to most gradient-forming materials other than sucrose and glycerol. Stainless steel tubes are very strong and can be centrifuged when filled to any level. Stainless steel tubes can be used indefinitely if they are undamaged and not allowed to corrode. They may be autoclaved as long as they are thoroughly dried before storage.

Microfuge Tubes



Microfuge tubes, 1.5-mL tubes with attached caps, are made of clear polyallomer or of clear or colored polypropylene. They are used in microplate carriers. The number and arrangement of microfuge tubes in opposing carriers should be balanced.

MICROPLATE CARRIERS



Microplate carriers (358680, qty/2) are installed on the rotor pivot pins in place of the buckets normally used with the rotor. The carriers are made of aluminum and are black-anodized for corrosion resistance. Each microplate carrier can accommodate up to three 96-well multiwell plates (when more than one plate is run, up to three plates are placed directly on top of one another).

Refer to Table 4 for a list of labware that can be used with the microplate carriers. Rotor speed must not exceed 2600 rpm when microplate carriers are run. For complete microplate carrier information, see publication J6-TB-009, included with the carriers.

OPERATION

- Precool the rotor and buckets or carriers 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.

Table 4. Labware for Use with Microplate Carriers

Description	Volume	Part Number	Required Accessory		Rack
			Description	Part Number	
Multiwell plate, 96-well, nonsterile, without caps	300 μ L/well	609844 (pkg/100)	—	—	—
Microfuge® tube, polyallomer, clear	1.5 mL	357448 (pkg/500)	Rack insert, white	373696 (pkg/25)	373661 (holds 24 tubes)
Microfuge tube, polypropylene, clear	1.5 mL	356090 (pkg/500)	Rack insert, white	373696 (pkg/25)	373661 (holds 24 tubes)
Microfuge tube, polypropylene, blue	1.5 mL	356091 (pkg/500)	Rack insert, white	373696 (pkg/25)	373661 (holds 24 tubes)
Microfuge tube, polypropylene, green	1.5 mL	356092 (pkg/500)	Rack insert, white	373696 (pkg/25)	373661 (holds 24 tubes)
Microfuge tube, polypropylene, yellow	1.5 mL	356093 (pkg/500)	Rack insert, white	373696 (pkg/25)	373661 (holds 24 tubes)
Microfuge tube, polypropylene, orange	1.5 mL	356094 (pkg/500)	Rack insert, white	373696 (pkg/25)	373661 (holds 24 tubes)

- If you are using a microprocessor-controlled J6 series centrifuge, enter rotor code **5.2** for the JS-5.2, or code **4.0** for the JS-4.0 rotor.
- Apply a thin film of Spinkote™ lubricant to the centrifuge drive spindle hub.

INSTALLING THE ROTOR

Two drive pins inside the rotor drive hole (see Figure 1) engage with teeth on the centrifuge drive spindle hub to prevent the rotor from slipping during acceleration and deceleration. When the rotor is properly installed, the pins sit in the drive hub grooves or next to the drive hub teeth (see Figure 2).

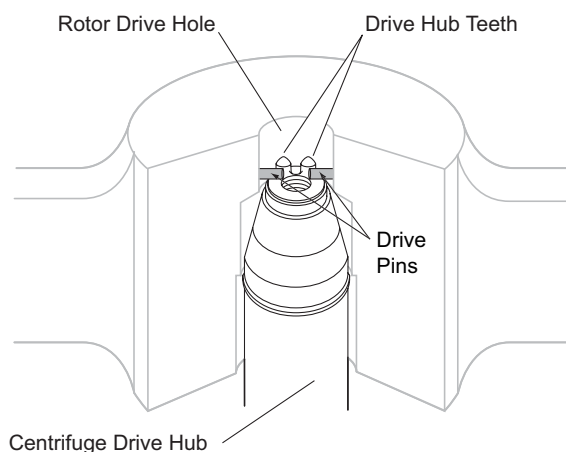


Figure 1. Rotor Drive Pin Location and Orientation

1. Hold the rotor with both hands and carefully lower the rotor yoke straight down onto the centrifuge drive spindle hub. Slowly rotate the yoke back and forth to make sure that it is properly seated.



CAUTION

Never drop the rotor yoke onto the drive spindle hub. The drive spindle can be bent if the yoke is dropped onto it.

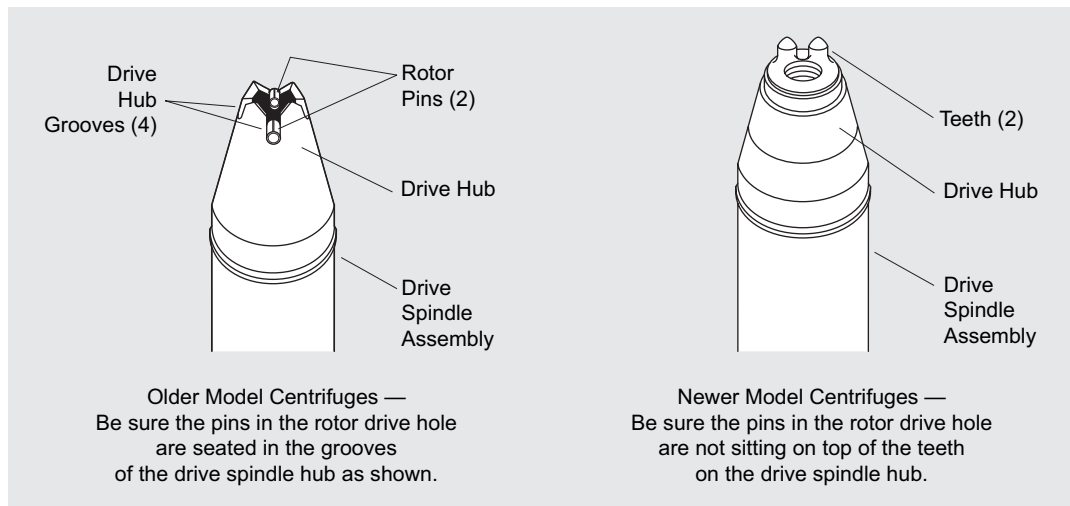


Figure 2. Centrifuge Drive Spindle Hub Configuration

2. After the rotor is properly seated, secure it to the drive hub with the tie-down bolt (368518). Tighten the bolt with the tie-down tool (368521), then remove the tool. This system is shown in Figure 3. Older rotors may have a tie-down screw (339031) which is tightened with a torque bar (878439), as shown in Figure 4.

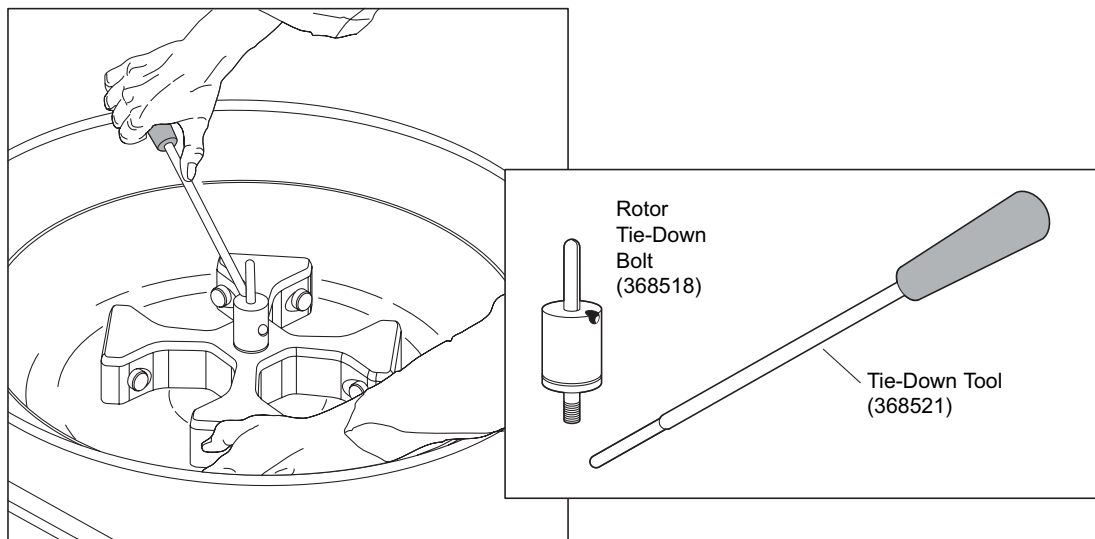


Figure 3. Using the Tie-Down Bolt and Tie-Down Tool to Tighten the Rotor onto the Drive Hub

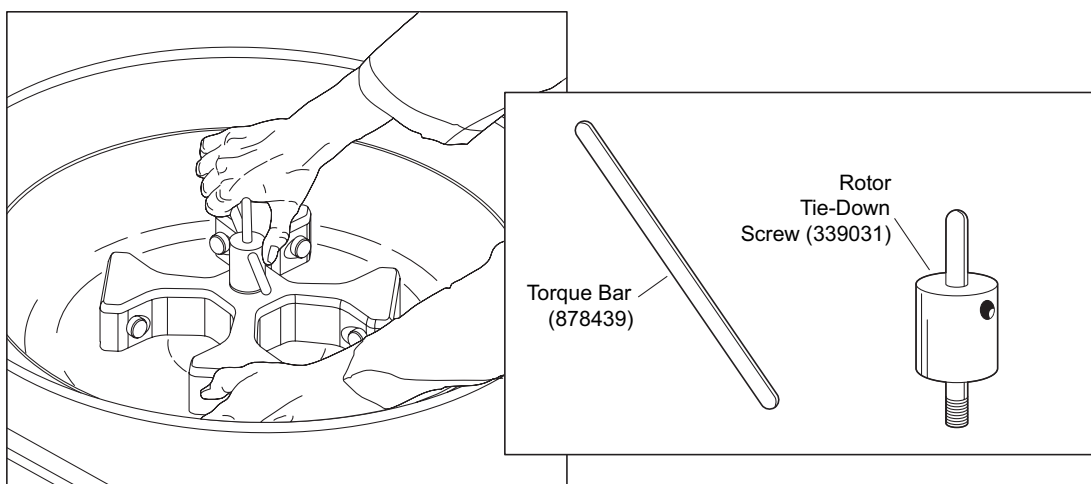


Figure 4. Using the Tie-Down Screw and Torque Bar to Tighten the Rotor onto the Drive Hub (Older Rotors)

3. *JS-5.2 rotor only:* Place the lid onto the rotor, carefully seating it on the windshield. Make sure that the tie-down bolt pin protrudes into the hole in the lid knob. *If you keep the rotor in the centrifuge, re-tighten the tie-down bolt before each run.*

INSTALLING THE BUCKETS OR MICROPLATE CARRIERS

1. Lubricate the contact area between the buckets or carriers and the pivot pins on the rotor yoke as described under MAINTENANCE.
2. Place buckets or carriers over the pivot pins on the rotor yoke. Fill all four positions with a bucket or carrier.
3. Make sure that the buckets or carriers are properly seated by gently swinging them on the pivot pins.



CAUTION

All four positions on the rotor yoke must contain either a bucket or a microplate carrier (loaded or unloaded) during a run. Never run the rotor without all four positions being filled.

LOADING THE BUCKETS AND CARRIERS



WARNING

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. Handle other infectious samples according to good laboratory procedures and methods to prevent spread of disease. Because spills may generate aerosols, observe proper safety precautions for aerosol containment. Do not run toxic, pathogenic, or radioactive materials in this rotor without taking appropriate safety precautions. Biosafe containment should be used when Risk Group II materials (as identified in the World Health Organization *Laboratory Biosafety Manual*) are handled; materials of a higher group require more than one level of protection.

When working with potentially hazardous materials, always fill or open containers in an appropriate hood or biological safety cabinet. Capped tubes or bottles are designed to provide fluid containment. We strongly recommend that all containers carrying physiological fluids be capped to prevent leakage.



CAUTION

Load adapters, cups, buckets, or microplate carriers first before placing them into the installed rotor to avoid damaging the centrifuge.

Symmetric and Balanced Loading

To ensure optimal performance and stability, load the rotors symmetrically (see Figure 5). Two factors affect symmetric loading:

- the rotor must be loaded symmetrically with respect to its center of rotation.
- the buckets or microplate carriers must be loaded symmetrically with respect to their pivotal axes.

This means that for best results you should load opposing buckets or carriers with the same type of labware containing the same amount of fluid of equal density. Two or four sample loads can be run. Opposing buckets or carriers and their contents must weigh within 10 grams of each other.

During a run, buckets (or carriers) swing 90 degrees from their at-rest position. The pivotal axis of a bucket can be imagined as a line extending across the bucket from one pivot pin to the other. If a bucket is loaded so that its weight is unequally distributed on either side of its pivotal axis, it will not hang vertically at rest and, more importantly, may not swing to a horizontal position during a run (see Figure 6). As a result, extra stress will be placed on the bucket and labware during the run, increasing the possibility of breakage or rotor imbalance.

LOADING BUCKETS

Load buckets before or after they are installed on the rotor yoke. In either case, we recommend filling the labware first and then loading the labware into the buckets. This is especially important when using blood bags—you can trip the imbalance detector in the centrifuge by pushing blood bag cups into buckets installed in the rotor.

Refer to Tables 1 through 4 to determine the appropriate labware for your application. Whether you are running tubes, bottles, or blood bags, you must load the buckets symmetrically around the center of rotation and each bucket must be loaded symmetrically with respect to its pivotal axis (see **Symmetric and Balanced Loading**, above).

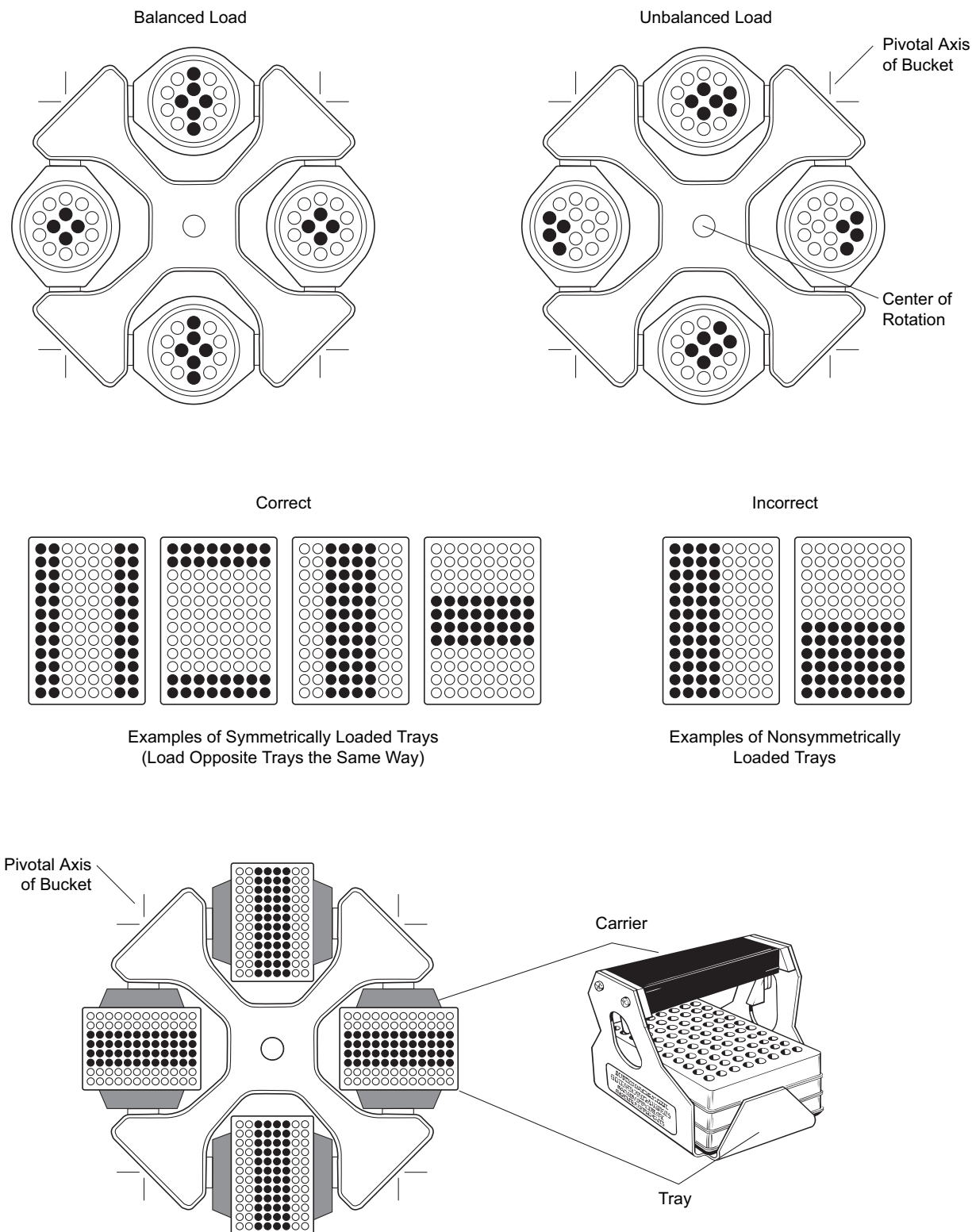


Figure 5. Examples of Correctly and Incorrectly Loaded Buckets and Carriers.
Contents of opposing buckets or carriers must be the same
and each bucket or carrier must be balanced on its pivotal axis.

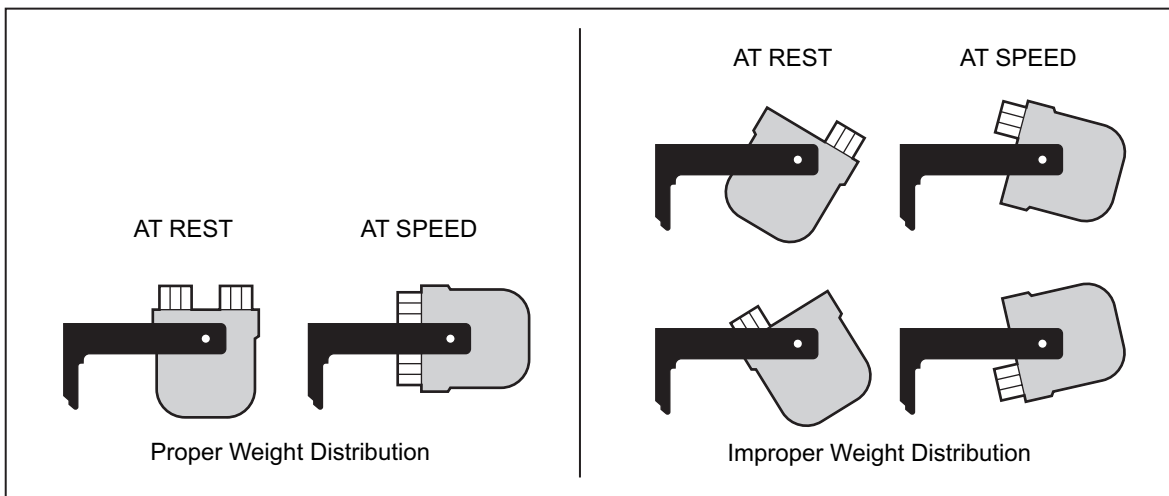


Figure 6. Examples of the Effects on the Horizontal Swing of Buckets Caused by Proper and Improper Weight Distribution.

Assembling Multi-Disc Adapters

1. Slide the U-shaped bracket into the grooved, black rubber adapter base (see Figure 7). Modified bracket 343369 is required if you are using Aeroseal Covers.
2. Place the base and bracket on a lab bench (not in the rotor).
3. Position one of the disks so that its grooves are aligned with the bracket. Push the disk down until the bracket snaps into the grooves.

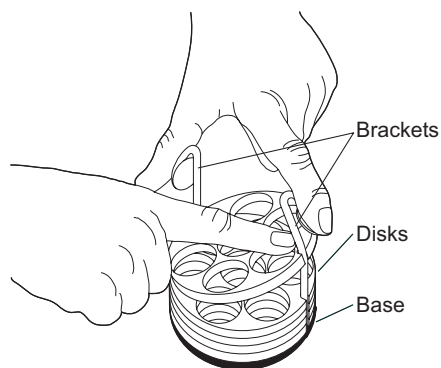


Figure 7. Assembling a Multi-Disc Adapter

4. Add more disks until the height of the assembly is nearly as tall as the tubes you will be using. Remove or add disks to the bracket to accommodate shorter or longer tubes. If the tubes fit too snugly in the adapter's rubber base, apply a light film of powder, such as talcum powder, to prevent the tubes from sticking. To disassemble the adapters, pry back the bracket arms by hand and remove the discs. As a safety precaution, the discs have been designed so that they cannot slide up off the bracket.

NOTE

Do not intermix Beckman Coulter GH-3.8 rotor style Multi-Disc adapters with adapters for the JS-5.2 and JS-4.0 rotors. The adapters are similar in appearance (see Figure 8), but they have very different weights. Mixing them during a run can cause imbalance.

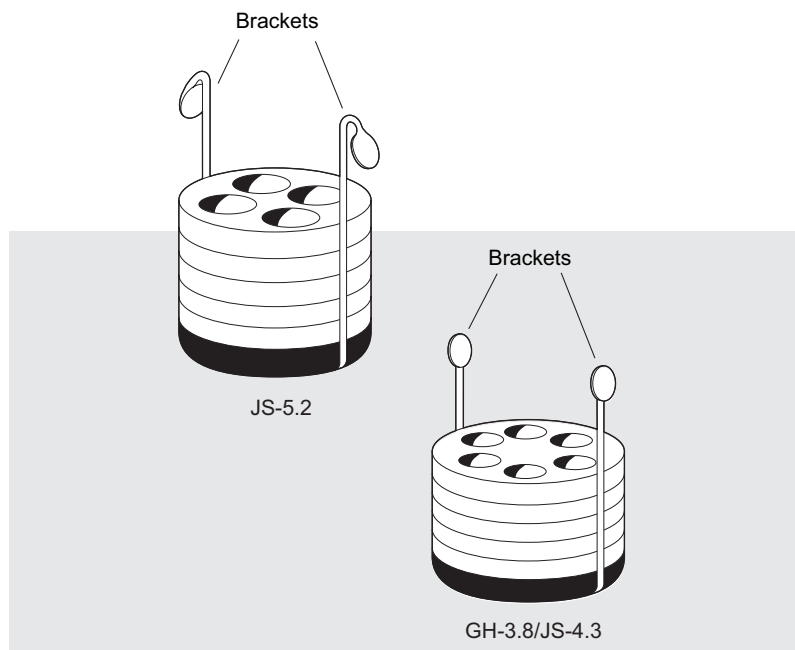


Figure 8. Brackets (Vertical Supports) for the JS-5.2-Style Multi-Disc Adapters and the GH-3.8-Style Modular Disk Adapters

Loading Adapters

1. First, test to make sure that the tubes or bottles in the adapters will not contact the rotor yoke during centrifugation. Place empty tubes or bottles in an adapter and then place the adapter in a bucket on the rotor yoke. Manually swing the bucket to horizontal position and make sure that all tubes clear the yoke.
2. Place filled tubes or bottles in the assembled adapters. If all positions in an adapter are not filled, load the adapter symmetrically with respect to its pivotal axis (see **Symmetric and Balanced Loading**, above).
3. Place the adapters into the buckets so that the brackets line up with the rotor pivot pins. If two or four loaded adapters are run, place them in opposite buckets and place empty buckets in the other positions on the yoke. If three loaded adapters are run, leave a space between each filled bucket on the rotor yoke and place three empty buckets in the open positions.

Loading Blood Bag Cups

To load blood bag cups, follow the recommended loading procedure provided by the blood bag manufacturer. With any blood bag, ensure the following conditions.

- When loaded into the cups and buckets, the blood bags must be as vertical as possible with no folds at the top or corners.
- The superstructure of the blood bag protruding from the cup must not inhibit the bucket from swinging out to horizontal position. Test each bucket by swinging it gently to make sure that it reaches horizontal position. If it does not, remove the cup from the rotor and reposition the blood bag so that it seats further into the cup. Allowing a blood bag to contact the rotor yoke during centrifugation can cause the bucket to come off the pivot pins and can seriously damage the rotor and the centrifuge.
- If two blood bags are run, place them in cups in opposing buckets. Place empty buckets in the other positions. Do not run the rotor with fewer than four buckets installed, whether loaded or empty.

LOADING MICROPLATE CARRIERS

1. To prevent multiwell plate breakage during centrifugation, place a rubber pad (341830) on the bottom of each carrier.
2. Tilt the carrier and insert the filled labware, being careful not to spill the contents. A 96-well cap strip (267002) may be placed over a filled multiwell plate to prevent leakage. If you are using two or three multiwell plates per carrier, place a cap strip (267002) between the plates to prevent breakage during centrifugation.

NOTE

Do not intermix microplate carriers for the Beckman Coulter JS-5.2 and JS-4.0 rotors with those used in the JS-4.2 and JS-3.0 rotors. The carriers look similar, but have different weights and maximum speeds. Each carrier is marked with its maximum speed and the rotors it can be used in; before each run, check that you are using the correct carriers for your rotor. Mixing carriers during a run can cause imbalance. See publication J6-TB-009, shipped with the carriers, for more information.

RUN SPEEDS

The centrifugal force at a given radius in a rotor is a function of the rotor speed. Comparisons of forces between different rotors are made by comparing the rotors' relative centrifugal fields (RCF). When rotational speed is selected so that identical samples are subjected to the same RCF in two different rotors, the samples are subjected to the same force (see Table 5).

The data in Table 5 apply to the JS-4.0 rotor only up to its maximum rated speed of 4000 rpm.

NOTE

Entries in Table 5 are calculated from the formula $RCF = 1.2 r (RPM/1000)^2$ and then rounded to three significant digits.

Table 5. Relative Centrifugal Fields.
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 ($\times g$)					
	Buckets			Microplates		
	At r_{\max} (226 mm)	At r_{av} (156 mm)	At r_{\min} (86 mm)	At r_{\max} (192 mm)	At r_{av} (178 mm)	At r_{\min} (164 mm)
5200	6840	4720	2600			
5000	6330	4370	2410			
4500	5130	3540	1950			
4000	4050	2800	1540			
3500	3100	2140	1180			
3000	2280	1570	866			
2600	1710	1180	651	1459	1350	1240
2500	1580	1090	602	1340	1250	1150
2000	1010	698	385	860	797	734
1500	569	393	216	483	448	413
1000	253	174	96	215	199	183

The rotors can process solutions at the maximum rated speeds only if the solution density is 1.2 g/mL or less. Rotor speeds must be reduced from the rated maximum under any of the following circumstances:

- If the JS-5.2 rotor is run without a lid, limit the speed to 1450 rpm. The additional windage created by not using the lid will overload the centrifuge drive and refrigeration systems above this speed.
- Maximum speed when microplate carriers are used is 2600 rpm in all rotors.
- When centrifuging solutions of densities greater than 1.2 g/mL, compute the maximum allowable speed from the following formula:

$$RPM = (\text{maximum rated speed}) \sqrt{\frac{2500 \text{ grams}}{\rho}}$$

where ρ = the weight in grams of the bucket and its contents.

RUN TEMPERATURE

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

Avanti J Series Centrifuges

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

Microprocessor-Controlled J6 Series Centrifuges

Enter rotor code **5.2** (for the JS-5.2) or rotor code **4.0** (for the JS-4.0) and 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 6 that corresponds with the set temperature and run speed. The compensation values listed in Table 6 are approximates for all J6 series 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.

Table 6. Temperature Compensation Settings for J6 Series Centrifuges

Rotor Speed (rpm)	Required Sample Temperature (°C, green bar)						
	2°C	4°C	8°C	10°C	15°C	20°C	30°C
5200	−3	−1	4	6	10	17	28
4000	−1	1	5	7	12	19	29
3000	0	2	7	9	14	20	30
2000 and below	2	4	8	10	15	20	30

- b. Place the filled, precooled rotor in the centrifuge and run the system for at least one-half 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 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**].

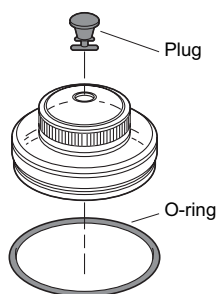
NOTE

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

CARE AND MAINTENANCE

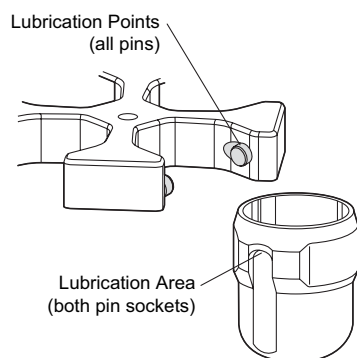
INSPECTION

- Periodically (at least monthly) inspect the rotor yoke and buckets 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.
- Regularly check the condition of the tie-down bolt; if it is worn or damaged, replace it.
- Before each use, inspect Aeroseal cover sealing surfaces, especially the O-ring groove. It must be smooth and free of



scratches. Also ensure that the top 2.54 cm (1 in.) of the bucket is clean and smooth; buckets with scratches or gouges in this surface will not seal properly. Inspect the O-ring and plug for nicks, abrasions, and other damage. Replace damaged components with Beckman Coulter parts only; *do not use a substitute for the O-ring—it has been specifically selected for this application.*

MAINTENANCE



The rotor yoke, buckets, and microplate carriers are made of anodized aluminum. Do not use sharp tools on them, as scratches in the anodized surface may lead to corrosion.

- After cleaning and before reinstalling the rotor body in the centrifuge, apply a light, even film of Spinkote lubricant (306812) to the centrifuge drive hub to prevent the rotor from sticking.
- Approximately once a week (or every 80 runs) and after cleaning and/or autoclaving, lubricate the contact area between the buckets or carriers and the pins. Saturate a lintless tissue with Tri-Flow² oil (883371) and wipe it on each bucket or carrier socket and pin. Also put a drop of Tri-Flow between the pin and the rotor yoke.

NOTE

Periodically remove Tri-Flow that may accumulate by wiping the rotor windshield or centrifuge chamber clean with a lintless cloth or tissue.

- Lubricate the O-ring and plug of Aeroseal bucket covers with silicone vacuum grease (335148). Also, lightly grease the inside top 1.2 cm (0.5 in.) of the bucket.

² Tri-Flow is a registered trademark of Thompson & Formby, Inc.

CLEANING

Under normal conditions, remove the rotor from the centrifuge at least once a week for cleaning and lubrication.

Rotor Components

- If spillage has occurred, or if salt solutions or other corrosive materials are used, clean the rotor and components immediately. Do not allow corrosive materials to dry on rotor components.
- Approximately once a week (or every 80 runs), clean the pins and bucket pin sockets, then lubricate as described under MAINTENANCE.



Most laboratory detergents are too harsh for use on aluminum rotors because they can damage the anodized surface. Use a mild detergent such as Beckman Solution 555™ (339555), diluted 10 to 1 with water, and a soft brush to clean the rotor yoke and tie-down bolt. The Rotor Cleaning Kit (339558) contains two quarts of Solution 555 and brushes that will not scratch the rotor.

Thoroughly rinse the cleaned rotor and components with water and air-dry. Do not use acetone to dry the rotor. When the rotor is dry, lubricate the bucket sockets and pins as described under MAINTENANCE. Before reinstalling the rotor, lightly lubricate the centrifuge drive hub with Spinkote to prevent the rotor from sticking.

Buckets

1. Clean the buckets with a mild detergent such as Solution 555 (339555), diluted 10 to 1 with water, then rinse thoroughly and dry completely.
2. After cleaning, lubricate bucket pin sockets with Tri-Flow (883371) as described under MAINTENANCE.

Multi-Disc Adapters

1. To disassemble adapters for washing, pull the bracket out of the groove in the disks, then remove the disks and unsnap the bracket from the rubber bottom.
2. Use a mild detergent such as Solution 555 (339555), diluted 10 to 1 with water, and a soft brush to scrub the adapters.
3. Rinse and dry, then reassemble.
4. If necessary, apply a light film of silicone vacuum grease (335148) to the grooves on the rubber adapter bottom to make reassembling easier.

Keep matched sets of adapters together; do not intermix sets.

DECONTAMINATION



If the rotor yoke, buckets, and/or microplate carriers become contaminated with radioactive material, decontaminate them using a solution that will not damage their anodized surfaces. Beckman Coulter has tested a number of solutions and found several that do not harm anodized aluminum: RadCon Surface Spray or IsoClean Solution for soaking),³ and Radiacwash.⁴

NOTE

IsoClean can cause fading of colored anodized surfaces. Use it only when necessary and remove it promptly from surfaces.



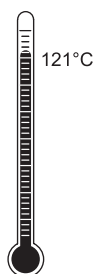
While Beckman Coulter has tested these methods and found that they do not damage components, no guarantee of decontamination is expressed or implied. Consult your laboratory safety officer regarding the proper decontamination methods to use.

If the rotor or other components are contaminated with toxic or pathogenic materials, follow appropriate decontamination procedures as outlined by your laboratory safety officer.

³ In the United States, contact Nuclear Associates (New York); in Eastern Europe and Commonwealth States, contact Victoreen GmbH (Munich); in South Pacific, contact Gammasonics Pty. Ltd. (Australia); in Japan, contact Toyo Medic Co. Ltd. (Tokyo).

⁴ In the United States, contact Biodex Medical Systems (Shirley, NY); internationally, contact the U.S. office to find the dealer nearest you.

STERILIZATION AND DISINFECTION



The rotor yoke, buckets, microplate carriers, and tube adapters can be autoclaved at 121°C for up to an hour. Blood bag cups can be autoclaved at that temperature for about 15 minutes. Ethanol (70%)⁵ may be used on all rotor components, including those made of plastic and rubber. See Appendix A in *Rotors and Tubes* for more information regarding chemical resistance of tubes, bottles, and accessories.

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.

⁵ Flammability hazard. Do not use in or near operating centrifuges.

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, which may be obtained from your local Beckman Coulter sales office, should contain the following information:

- serial number,
- history of use (approximate frequency of use),
- reason for the return,
- original purchase order number, billing number, and shipping number, if possible,
- name and phone number of the person to be notified upon receipt of the rotor or accessory at the factory, and
- name and phone number of the person to be notified about repair costs, etc.

To protect our personnel, it is the customer's responsibility to ensure that the parts are free from pathogens and/or radioactivity. Sterilization and decontamination must be done before returning the parts. Smaller items (such as tubes, bottles, etc.) should be enclosed in a sealed plastic bag.

*All parts must be accompanied by a note, plainly visible on the outside of the box or bag, stating that they are safe to handle and that they are not contaminated with pathogens or radioactivity. **Failure to attach this notification will result in return or disposal of the items without review of the reported problem.***

Use the address label provided on the RGA form to mail the rotor or parts to:

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

Attention: Returned Goods

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

SUPPLY LIST

NOTE

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; worldwide offices are listed on the back of this manual) or see the *Beckman Coulter High Performance, High Speed, High Capacity Rotors, Tubes, & Accessories* catalog (BR-8102, available at www.beckmancoulter.com) for detailed information on ordering parts and supplies. For your convenience, a partial list is given below.

REPLACEMENT ROTOR PARTS

Rotor assembly, JS-5.2	339087
Contains one rotor body with attached windshield, one rotor cover assembly (339085), round buckets, set of 4 (341710), rotor tie-down kit (367045)	
Rotor assembly, JS-4.0	339086
Contains one rotor body (no windshield), round buckets, set of 4 (341710), rotor tie-down kit (367045)	
Rotor buckets (set of 4)	341710
Aeroseal cover for round buckets (1)	343686
Rotor cover assy (JS-5.2 only)	339085

SUPPLIES

Blood bag cups	see Table 3
Microplate carriers (set of 2, includes rubber pads)	358680
Microplate carrier labware	see Table 4
Rubber pad for use in microplate carriers (1)	341830
96-well cap strip, nonsterile (pkg/12)	267002
Multi-disc adapters (polypropylene)	See Table 2
Tubes and bottles	see Table 1
Rotor Cleaning Kit	339558
Rotor tie-down kit	367045
Contains tie-down bolt (368518) and tie-down tool (368521)	

Silicone vacuum grease (1 oz)	335148
Solution 555 (1 qt).	339555
Spinkote lubricant (2 oz).	306812
Tri-Flow Superior Lubricant with Teflon (2 oz)	883371

J SERIES SWINGING BUCKET ROTOR WARRANTY

Subject to the conditions specified below and the warranty clause of the Beckman Coulter, Inc., terms and conditions of sale in effect at the time of sale, Beckman Coulter, Inc. agrees to correct either by repair, or, at its election, by replacement, any defects of material or workmanship which develop within seven (7) years after delivery of a J series rotor to the original buyer by Beckman Coulter, Inc. or by an authorized representative, provided that investigation and factory inspection by Beckman Coulter discloses that such defect developed under normal and proper use. Should a Beckman Coulter centrifuge be damaged due to a failure of a rotor covered by this warranty, Beckman Coulter will supply free of charge all centrifuge parts required for repair.

REPLACEMENT

Any product claimed to be defective must, if requested by Beckman Coulter be returned to the factory, transportation charges prepaid, and will be returned to Buyer with the transportation charges collect unless the product is found to be defective, in which case Beckman Coulter will pay all transportation charges.

A defective rotor will be replaced by Beckman Coulter at its then current list price less a credit based upon the age of the rotor (years since date of purchase). The Buyer shall not receive credit until the claimed defective rotor is returned to Beckman Coulter's Palo Alto, California, facility or delivered to a Beckman Coulter Field Service representative.

The replacement price (cost to Buyer) for the respective rotor shall be calculated as follows:

$$\text{Replacement price} = \text{Current rotor list price} \times \frac{\text{years}}{7}$$

CONDITIONS

1. Except as otherwise specifically provided herein, this warranty covers the rotor only and Beckman Coulter shall not be liable for damage to accessories or ancillary supplies including but not limited to (i) tubes, (ii) tube caps, (iii) tube adapters, or (iv) tube contents.

2. This warranty is void if the rotor has been subjected to customer misuse such as operation or maintenance contrary to the instructions in the Beckman Coulter rotor or centrifuge manual.
3. This warranty is void if the rotor is operated with a rotor drive unit or in a centrifuge unmatched to the rotor characteristics, or is operated in a Beckman Coulter centrifuge that has been improperly disassembled, repaired, or modified.
4. Each bucket, whether purchased with a rotor assembly or purchased separately, is covered by this warranty for seven (7) years from the date of purchase, and will be replaced or repaired during such period according to the terms and conditions of this warranty. The date of manufacture marked on the bucket may be earlier than the date of purchase, and the expiration date marked on the bucket, which is seven (7) years after the date of purchase, may be correspondingly offset.
5. Buckets should not be used after the expiration date marked on the bucket. If at the time of purchase the marked expiration date is less than 7 years from the date of purchase, the expiration date becomes the date of purchase plus seven (7) years. Use of a bucket after such expiration date voids Beckman Coulter's warranty obligations with respect to any rotor and/or centrifuge in which such a bucket is used.

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 THAT 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.

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