



Angle Rotors for Refrigerated Centrifuge


Before using these rotors,
please carefully read this instruction
manual for its efficient operation and for
your safety.
Keep this instruction manual for your
reference and refer to it as required.

Safety Reminder

- Centrifuge rotors rotating at high speed have considerable potential for damage to personal properties if used improperly.
For safe and proper use of this rotor, carefully read the centrifuge instruction manual and this rotor instruction manual before use and observe the instructions.

 **WARNING :** and  **CAUTION :** notes are used to call your attention in this manual to prevent personal injury or damage to the rotor and the centrifuge.
These notes are defined as follows.

 **WARNING:** indicates a potentially hazardous situation which, if not avoided, could result in personal severe injury or possible death.

 **CAUTION:** indicates a hazardous situation which, if not avoided, could result in personal injury or severe damage to the instrument.

WARNING

- Never use any material capable of producing flammable or explosive vapors.
- Your centrifuge and rotor are not designed to confine any sample particles dispersed due to leakage. Therefore, when using toxic or radioactive samples or pathogenic or infectious blood samples, make sure to prepare necessary safety measures at your own responsibility.
- Never exceed the maximum speed of the rotor (mentioned on the rotor).
Always reduce rotor speed as instructed in this manual when rotor speed is limited due to sample density or kinds of tubes.
- Check the attached chemical resistance chart, and do not use any sample inapplicable to the rotor.
- If the centrifuge, rotor, or an accessory is contaminated by samples that are toxic or radioactive, or blood samples that are pathogenic or infectious, be sure to decontaminate the item according to good laboratory procedures and methods.
- If there is a possibility that the centrifuge, rotor, or an accessory is contaminated by samples that might impair human health (for example, samples that are toxic or radioactive, or blood samples that are pathogenic or infectious), it is your responsibility to sterilize or decontaminate the centrifuge, rotor, or the accessory properly before requesting repairs from an authorized sales or service representative.
- It is your responsibility to sterilize and/or decontaminate the centrifuge, rotor, or parts properly before returning them to an authorized sales or service representative.

CAUTION

- Do not run the rotor without the rotor cover in position.
Tighten the cover-locking knob securely.
- Balance the tubes/bottles and the samples including the caps and the adapters within the allowable imbalance of the rotor. Do not exceed the allowable imbalance.
- Clean the inside of the drive hole (crown hole) of the rotor and the surface of the drive shaft (crown) of the centrifuge once a month. If the drive hole or the drive shaft is stained or any foreign matter is adhered, the rotor may be improperly installed and come off during operation.
- Use the rotor tubes and bottles within their actual capacities.
- Do not use tubes/bottles that have exceeded their life expectancy. Failure to do so could result in damage of tubes/bottles and the rotor and the centrifuge. The life expectancy of tubes/bottles depends on factors such as the characteristics of samples, speed of the rotor used, and temperature.
Always check for deterioration and damage (cracks, deformation, and so on) on tubes/bottles before using them. Do not use the tubes/ bottles if you find such a problem.
- Inspect and maintain the rotor after use. If abnormality is observed, do not use it.
Contact an authorized sales or service representative.

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1. Specifications

1.1 Specifications of rotors

The specifications of the angle rotor are shown in table 1-1.

Refer to "5.characteristic of rotor" for the characteristic of each rotor.

For the detailed information about accessories, refer to "6. Standard accessories and optional accessories"

Table1-1 Specifications of Angle Rotor

rotor model	Rotor No.	Max. speed (rpm)*1	Max. Centrifugal force($\times g$)	Tube nominal capacity (tubes \times mL)*2	Total Capacity (mL)	Tube size (cm)	Rotor Weight (kg)	Rotor body material *4
R21A	26	21,000	53,250	16 \times 11 mL	176	ϕ 1.6 \times 8.5	8.5	aluminum alloy
R14A	29	14,000	30,240	4 \times 250 mL	1,000	ϕ 6.2 \times 13.2	16.8	aluminum alloy
R14A3	44	14,000	29,100	10 *3 \times 80 mL	800 *3	ϕ 3.8 \times 10.4	12.9	aluminum alloy
R12A3	41	12,000	23,800	6 \times 250 mL	1,500	ϕ 6.2 \times 13.2	16.0	aluminum alloy
R12A4	48	12,000	23,800	72 \times 2 mL	144	ϕ 1.1 \times 4.1	7.7	aluminum alloy
R12A6	49	12,000	22,500	4 \times 500 mL	2,000	ϕ 7.3 \times 16.3	14.8	aluminum alloy

*1 Max. speed varies with model of centrifuge.

*2 Refer to "5.characteristic of rotor " for the actual capacity of tube.

*3 When using the seal tubes in R14A3 rotor, tube capacity is 100mL and total capacity is 1,000mL

*4 All of these rotor's covers are made of aluminum alloy.

1.2 Construction of rotors

The typical of the angle rotors is shown in Fig. 1-1.

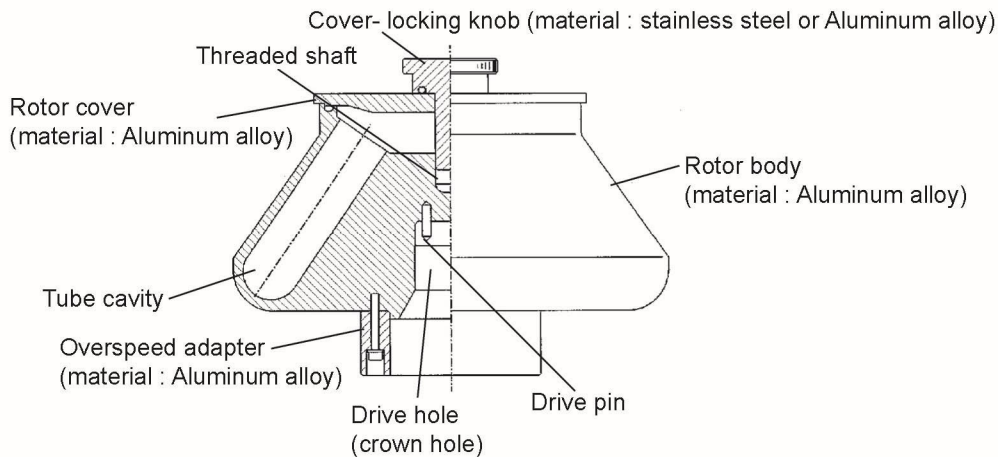


Fig1-1 Construction of angle rotor

1.3 Allowable speed of rotors

△ WARNING :

Do not exceed the maximum speed of the rotor. The rotor speed should be limited depending on sample characteristic, kinds of tube/ bottle and centrifuge model.
Do not exceed the allowable speed of the rotor.

The maximum speed marked on the surface of the rotor cover is permitted under the conditions as follows.

-Average sample density : less than 1.2g/mL

-Standard tubes/ bottles are used.

Depending on sample density, kinds of tube/ bottle and centrifuge model, the rotor speed may be limited as follows. Sample characteristic, kinds of tube/ bottle and centrifuge model. Do not exceed the allowable speed of the rotor.

(1) Allowable speed for sample density

△ WARNING :

When sample density exceed 1.2g/mL, calculate the allowable speed according to the following equation.

$$\text{Allowable speed (rpm)} = \text{maximum speed of rotor (rpm)} \times \sqrt{\frac{1.2(\text{g/mL})}{\text{Average density of sample (g/mL)}}}$$

(2) Allowable speed for combination of tube/bottle, cap, adapter, etc.

The rotor speed should be limited by combination of tube/bottle, cap, adapter, etc.

For details, visit our website.

When using tubes, bottles, etc. on the market, perform operation under the allowable speed or the allowable RCF specified by manufacturer. Otherwise, tubes, bottles, etc. may be broken during operation.

(3) Allowable speed for centrifuge model

Allowable speed varies with centrifuge model. Operate these rotors at the allowable speed or less.

See "Applicable centrifuges (Rotors for refrigerated centrifuges) (Part No.S998611)."

1.4 Sample limitations

△ WARNING :

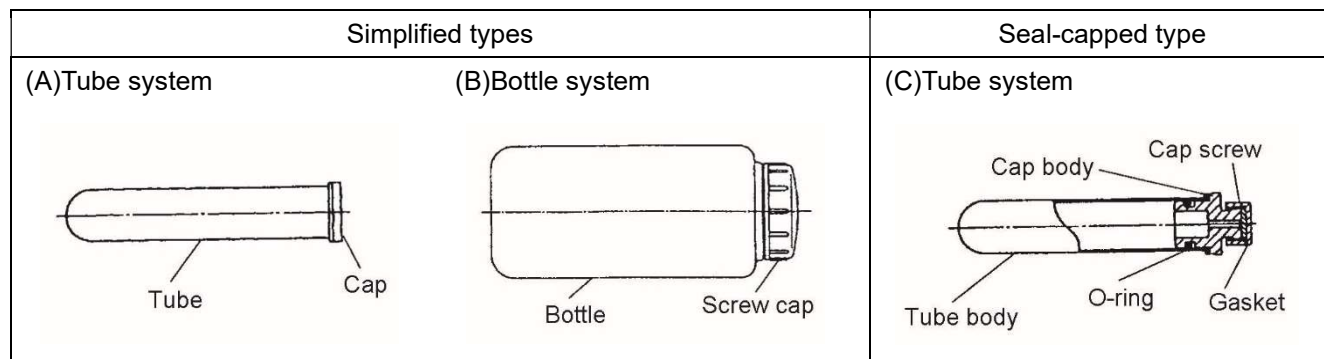
- These rotors and the centrifuge are not explosion-proof. Never use explosive or flammable samples.
- For safety, there are limits on the use of bio-samples which require bio-isolation, such as pathogenic germs and DNA recombination, as well as RI substance in centrifuges. Perform strict safety controls when separating samples containing these substances.

2. Tubes and bottles

2.1 Kinds of tubes and bottles

2.1.1 Standard accessory tubes and bottles of rotors

Following table shows general types of tubes and bottles. Refer to "2.1.2 Tubes for rotors requiring commercial tubes" for R12A4 rotor.



Tubes and bottles are made of the following materials.

PA: Polyallomer (ethylene-propylene copolymer)···It is translucent and highly chemical-resistant.
It is autoclavable at 115°C or lower.

PC: Polycarbonate ··· It is transparent and strong. It is autoclavable at 121°C or lower.

PE: Polyethylene ····· It is opaque and highly chemical-resistant. It is not autoclavable.

PP: Polypropylene ··· It is strong but susceptible to low temperature (brittle point: 0°C).
It is autoclavable at 121°C or lower.

SST: Stainless steel ··· It is highly heat-resistant and chemical-resistant against organic solvents etc.
It is autoclavable at 121°C or lower.

Glass ····················· It is transparent and highly heat-resistant.

Refer to the attached "Chemical resistance chart (Part No. S999313)" for chemical resistance of each material.

2.1.2 Tubes for rotors requiring commercial tubes

●R12A4 rotor

The rotor does not include accessory tubes. Purchase the tubes and adapters specified in Table 2-1 separately.

Table 2-1 Applicable tubes and adapters

Capacity (mL)	Tube			Adapter		Maximum speed(rpm)
	Part No.	Part name	Material	Part No.	Part name	
2.0	(commercial product)	2.0mL microtube	PP	-	-	12,000
1.5	(commercial product)	1.5mL microtube	PP	-	-	12,000
0.7	(commercial product)	0.7mL microtube	PP	-	-	12,000
0.5	489239A	0.5 round-bottom glass tube	Glass	S414002A	0.5 adapter(B)	12,000
0.4	(commercial product)	0.5mL microtube	PP	S414004A	0.75 adapter(B)	12,000
	(commercial product)	0.4mL microtube	PP	S414000A	0.4 adapter(B)	12,000
0.25	(commercial product)	0.25mL microtube	PP	S414000A	0.4 adapter(B)	12,000

*Eppendorf's tubes are recommended. For other commercial tubes, it is recommended to test for their quality before use because some commercial tubes cannot bear the maximum speed of the rotors.

2.2 Washing and sterilization of tubes/bottles

Properly wash and sterilize the tubes/bottles according to Table 2-1.

Comply with instructions of each maker for washing and sterilization of commercially available tubes.

- Autoclaving PA, PP and PC tubes/bottles

Wash the tubes/bottles well. Put them on a heat-resistant tube stand facing their mouths upward.

Remove the screw caps and the lids to prevent deformation or breakage during autoclaving. After autoclaving, wait until the temperature in the autoclaving chamber reduces to the room temperature, then take out the tubes/bottles.

- Washing

Wash the tubes/bottles with tap water or a dilute solution of neutral detergent. If the tubes/bottles stain heavily, soak them in a dilute solution of neutral detergent or wash them with a soft brush being careful not to scratch them. Then rinse the tubes/bottles in tap water and finally rinse them with distilled water. Dry the tubes/bottles in the air. Use a detergent of pH 5 to 9 because the PC tubes are susceptible to alkaline solutions. Avoid soaking the tubes/bottles in a dilute solution of neutral detergent for a long time. Otherwise, the tubes/bottles may be degraded in strength. For the caps of the tubes/bottles, remove them from the tubes/bottles then wash, dry and store the caps in the same manner as the tubes/bottles.

Table 2-1 Washing and sterilization of tubes/bottles

○: Applicable ×: Inapplicable

Conditions		Material	PE	PA	PC	PP	SST
Washing	Washing solution	pH 5 or lower	×	×	×	×	×
		pH 5 to 9	○	○	○	○	○
		pH 9 or higher	○	○	×	○	○
		Warm water (50°C or lower)	○	○	○	○	○
	Ultrasonic washing	Neutral detergent (pH 7)	○	○	○	○	○
Sterilization	High-pressure steam sterilization (Autoclaving)	115°C(0.7kg/cm ²), 30 minutes	×	○	○	○	○
		121°C(1.0kg/cm ²), 20 minutes	×	×	○	○	○
		126°C(1.4kg/cm ²), 15 minutes	×	×	×	×	×
	Boiling	For 15 to 30 minutes	×	○	○	○	○
	Ultraviolet ray	200-300nm	×	×	×	×	○
	Gas	Ethylene oxide	○	○	×	○	○
		Formaldehyde	○	○	○	○	×
	Chemical	Ethanol (70%)	○	○	×	○	○
		Hydrogen peroxide (3%)	○	○	○	○	○
Formalin (3%)		○	○	○	○	×	

2.3 Life expectancy of plastic tube and bottle

The life of plastic tube and bottle depends upon the sample, speed of rotor, temperature, etc. The standard life of plastic tube and bottle when used with aqueous samples (of pH5 to pH9) is specified as follows (in case they are used repeatedly for 1 hour at the maximum speed of rotor):

- (1) Tubes (PA, PP, PC and PE) 5 times
- (2) Thick-walled tube and bottle (PA, PP, PC and PE) 50 times
- (3) himac 50TC tubes and Commercial tubes 1 time

However, the standard life of the PC thick-walled tube and PC bottle is specified as follows depending upon the pre-treating conditions such as washing, sterilization, etc.:

Table 2-2 Standard Life of tube and bottle

Sample	Washing and sterilization	Sterilization in gas or washing in hot water	Autoclaving at 121°C × 20min
Neutral(pH7)		50 times	10 times
Weak alkali(pH7 to pH9)		30 times	5 times

3. How to use the rotor

3.1 Preparation of tubes/bottles

Check that the tubes/bottles are free from crack or deformation. Do not use remarkably deformed or cracked tubes/bottles.

⚠ CAUTION:

- Do not use any sample inapplicable to the tubes/bottles and the caps in use referring to the attached "Chemical resistance chart. Otherwise, the tubes/bottles and the caps may be degraded.
- Chemical resistance and the strength of tubes/bottles varies with speed, temperature, and so on. Before using sample, fill tubes/bottles with water, buffer solution, etc. instead of sample and run them at the intended speed, temperature, and so on to ensure that there is no abnormality.
- Do not exceed the specified sample capacity of the tubes/bottles. Otherwise, sample leakage or deformation of tubes may occur.
- Balance the sample within the allowable imbalance including the weight of the tubes/bottles, caps and adapters. Excessive imbalance can cause damage to the centrifuge and the rotor.
- Balance the same-density sample. Difference in sample density may result in imbalance operation.
- Use the tubes/bottles at a temperature between 4°C and 25°C, otherwise tubes/bottles may be broken or deformed during operation.

How to use the tubes may vary depending on the types of tubes as follows.

(1) Simplified type

Fill the tubes/bottles with the sample and put the lids and the screw caps on the tubes/bottles securely.

Do not invert or shake them, otherwise the sample may leak (because the simplified type does not include O-ring).

If the sample amount exceeds the actual capacity of the tubes/bottles, the sample will be leaked during operation.

Do not exceed the actual capacity of the tubes/bottles. Refer to "5. Characteristic of rotor" for the actual capacity of the standard accessory tubes/bottles. For other tubes/bottles and commercially available tubes/bottles, visit our website.

Do not exceed the allowable imbalance specified in Table 3-1 between the tubes symmetrically arranged in the rotor with respect to the drive shaft.

(2) Seal-capped type

Mount the O-ring to the cap body and push the gasket in the cap screw. Fill the tube 2/3 full of sample and push the cap body in. Inject sample into the tube with a syringe through the small hole to fill the tube to the capacity. Do not exceed the allowable imbalance specified in Table 3-1 between the tubes symmetrically arranged in the rotor with respect to the drive shaft. Securely tighten the cap screws.

- The stainless steel tubes are shipped in a set of two with very little difference in weight (1 g or less). The weight is engraved on the body. Set the two stainless steel tubes in the rotor symmetrically with respect to the drive shaft.
- Use of the optional balancer (refer to "6.2 Optional accessories of rotors") for balancing the bottles of 300 mL or more capacity.

Table 3-1 Allowable imbalance of each rotor

Rotor model	Allowable imbalance
R12A4	0.2 g maximum
R21A	0.5 g maximum
R14A3	2 g maximum
R14A, R12A3	4 g maximum
R12A6	6 g maximum

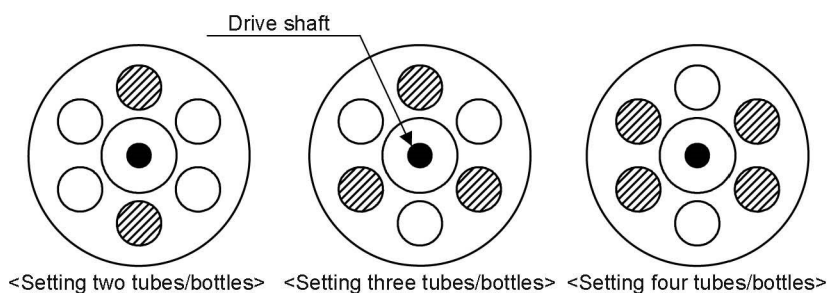
3.2 Setting tubes/bottles in the rotor

⚠ CAUTION:

Do not load only one tube/bottle nor arrange the tubes/bottles asymmetrically with respect to the drive shaft. Otherwise, the centrifuge or the rotor may be damaged due to excessive imbalance operation.

Check that the tube cavities of the rotor are free from foreign substances. Set the balanced tubes/bottles symmetrically with respect to the drive shaft as shown in the figure below.

Precool the rotor when the operating temperature of the rotor is lower than the room temperature or preheat the rotor when the operating temperature of the rotor is higher than the room temperature before setting the tubes/bottles in the rotor.



3.3 Mounting the rotor cover

⚠ CAUTION:

Be sure to mount the rotor cover to the rotor body and tighten the cover handle securely before operation. Otherwise, the rotor or the rotor cover may be removed during operation and result in damage to the centrifuge and the rotor.

(1) Apply silicone grease (vacuum grease) (standard accessory of the centrifuge) to the rotor packing and then fit the rotor packing in the groove of the rotor body or the cover. Replace the rotor packing with new one if damaged or deteriorated.

(The R12A4 rotor is not provided with the rotor packing).

(2) Apply lubricant for screw (Part No. 84810601) to the threaded portion of the cover handle. Put the rotor cover on the rotor body. Turn the cover handle to screw in the rotor body securely.

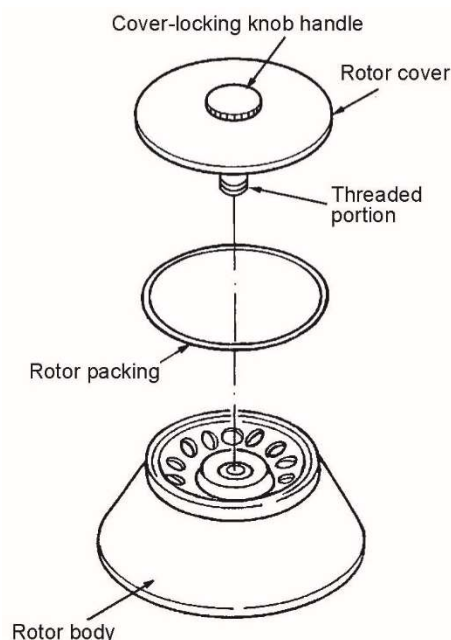


Fig. 3-1 Mounting the rotor cover

3.4 Operation

Mount the rotor onto the drive shaft of the centrifuge gently and securely. Check that the rotor cover is mounted and the cover handle is securely tightened. Perform operation according to the instructions of the centrifuge instruction manual.

3.5 Taking out samples

After the operation, gently take out the rotor from the centrifuge and remove the rotor cover by turning the cover handle. Take out the tubes/bottles from the rotor and then take out the sample in a proper manner.

4. Maintenance

4.1 Corrosion resistance of rotor

⚠ WARNING:

Check the attached chemical resistance chart, and do not use any sample inapplicable to the rotor.

The corrosion resistance of a rotor depends on the material (see Table 1-1 or Fig. 1-1 for the material of the rotor body). The rotors made of aluminum alloy have high corrosion resistance and they are covered with an anodic oxidation coating. However, use of inapplicable chemicals can corrode these rotors and decrease the strength. Use samples that will not affect the rotor referring to the attached chemical resistance chart.

4.2 Maintenance of rotor

After the operation, properly maintain the rotor to prevent corrosion that can cause the rotor breakage.

- Normal maintenance

⚠ CAUTION:

Clean the crown hole at the rotor bottom and the surface of the drive shaft of the centrifuge once a month. If there is a stain or a foreign substance in the crown hole or on the drive shaft, the rotor cannot be set onto the drive shaft properly and the rotor may come off during operation.

Wash the rotor with tap water or a dilute solution of neutral detergent and rinse it out with distilled water. Wipe the rotor with a soft cloth. Turn the rotor upside down with the rotor cover removed to dry it well. Check that the rotor is completely dried and then put a light coat of silicone grease (vacuum grease) (standard accessory of the centrifuge) on the rotor. Store the rotor in a dry place.

- Maintenance after use of a corrosive sample
Wash the rotor with tap water immediately after the operation. Then perform the normal maintenance.
- Maintenance when foreign substances are adhered to the rotor

⚠ CAUTION:

Use a neutral detergent having a pH between 5 and 9. Otherwise, the rotor can be discolored or corroded.

Soak the rotor in warm water for one or two hours and wash the inside of the tube cavities and the crown hole at the rotor bottom with a soft brush or a cleaning rod to remove foreign substances. Do not forget to remove foreign substances adhered in the crown hole at the rotor bottom. Otherwise, the rotor and the drive shaft may be damaged.

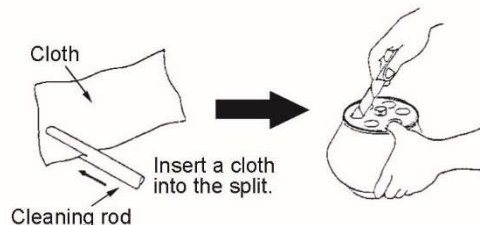


Fig. 4-1 How to use the cleaning rod

4.3 Sterilizing rotor (Except the autoclavable rotors)

- ⚠ WARNING: Never sterilize the rotor by autoclaving or boiling. Otherwise, the rotor will be brittle. It is very dangerous.
- ⚠ CAUTION: Never sterilize the adapters by autoclaving or boiling. Otherwise, the adapters may be deformed. Such adapters cannot be used.

- Sterilize the aluminum alloy rotors according to either gas sterilization method (ethylene oxide or formaldehyde) or chemical sterilization method (70% ethanol, 3% hydrogen peroxide, 3% formalin).
- Sterilize the plastic or rubber adapters according to either gas sterilization method (ethylene oxide or formaldehyde) or chemical sterilization method (70% ethanol, 3% hydrogen peroxide, 3% formalin).

- ⚠ CAUTION: Do not dip the rotor and the adapters in the formalin (3%) solution more than 2 hours.

- The R12A6 rotor is autoclavable. Sterilize the rotor according to the following.

4.4 Autoclaving rotor

The R12A6 rotor is autoclavable.

- Autoclave these rotors at 121°C for 20 minutes.

- ⚠ WARNING: Be sure to remove the rotor cover from the rotor before autoclaving. Otherwise, the rotor or the rotor cover may be deformed.
- ⚠ WARNING: Never sterilize the rotor by boiling. Otherwise, the rotor will be brittle.
- ⚠ CAUTION: Never sterilize the adapters by autoclaving or boiling. Otherwise, the adapters may be deformed. Such adapters cannot be used.
- ⚠ CAUTION: After autoclaving, wait until the temperature in the autoclaving chamber reduces to the room temperature, then take out the rotor and the rotor cover.
- ⚠ CAUTION: Take out the rotor and the rotor cover carefully from the autoclaving chamber as they are wet and slippery.

4.5 Inspecting rotor

Periodically check that the rotor is free from corrosion every 100 hours use. Especially be careful of the tube cavities of the rotor and the crown hole at the rotor bottom because the rotor can be brittle if these portions are corroded. If the rotor surface is discolored, dented or cracked, the rotor is corroded. Do not use such a corroded rotor and contact an authorized sales or service representative immediately for further inspection.

5. Characteristic of rotor

5.1 Calculation of separation time and calculation of relative centrifugal force

Conventionally, the performance index(Pi) has been used as a factor to estimate the settling time of particles. However, the K factor can conveniently be used which makes it possible to estimate the settling time directly from Svedberg unit(S).

Using the K factor, the settling time t(in hours) is expressed as follows:

$$t = \frac{K}{S} \dots \dots \dots (1)$$

Namely, the time taken for particles of 1S to settle from Rmin to Rmax is K factor. The K factor can be obtained from the formula show below.

$$K = \frac{\ln(R_{max}) - \ln(R_{min})}{\omega^2} \cdot \frac{10^{13}}{3600} \dots \dots \dots (2)$$

- ω : Angular velocity $\omega = 2 \pi / 60 \cdot N$
- N : Speed(rpm)
- R_{min} : Distance from axis of rotation to top of solution
- R_{max} : Distance from axis of rotation to bottom of tube

For example, the K factor at the maximum speed of 21,000rpm of Model R21A rotor is 301. The time taken for particles of 100 S to be settled from Rmin to Rmax using this rotor is as follows:

$$t = \frac{301}{100} \cong 3.0 \text{hours}$$

The time taken for settling of particles of 100 S by the same rotor at a speed of 15,000 rpm is:

$$K = \left(\frac{21,000}{15,000} \right)^2 \times 301 = 590 \quad t \times 590 / 100 \cong 5.9 \text{hours}$$

Refer to sections from 5.2 to 5.7 for specifications and characteristics of each rotor. For how to obtain a relative centrifugal force, see below.

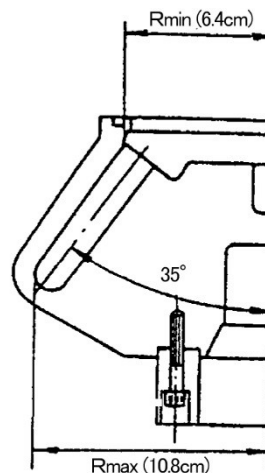
$$RCF(\times g) = 1,118 \times R(\text{cm}) \times N^2(\text{rpm}) \times 10^{-8}$$

- R : Spinning radius(cm)
- N : Speed(rpm)

5.2 R21A rotor

(1) Specifications

Maximum speed · 21,000rpm
 Maximum RCF · 53,250×g
 Tube capacity ··· 11mL×16 (Actual capacity of 11PA tube: 8.2 mL)
 Tube size ······ φ 1.6cm×8.5cm
 Tube angle ······ 35°
 Rotor weight ····· 8.5kg
 Rotor number ····· 26



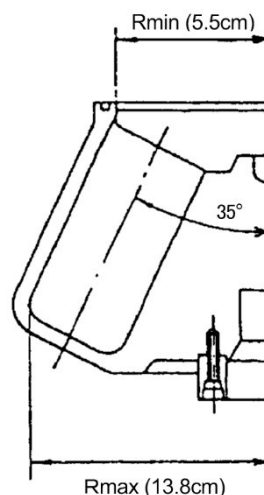
(2) Characteristics (when using the 50PA tubes)

Rotor speed (rpm)	RCF (xg)		K factor
	R=Rmin (6.4cm)	R=Rmax (10.8cm)	
2,000	286	483	33,135
4,000	1,140	1,930	8,284
6,000	2,580	4,350	3,682
8,000	4,580	7,730	2,071
10,000	7,160	12,100	1,325
12,000	10,300	17,400	920
14,000	14,000	23,700	676
16,000	18,300	30,900	518
18,000	23,200	39,100	409
20,000	28,600	48,300	331
21,000	31,600	53,250	301

5.3 R14A rotor

(1) Specifications

Maximum speed · 14,000rpm
 Maximum RCF · 30,240×g
 Tube capacity ··· 250mL×4 (Actual capacity of 250PP bottle: 250 mL)
 Tube size ······ φ 6.2cm×13.2cm
 Tube angle ······ 35°
 Rotor weight ····· 16.8kg
 Rotor number ····· 29



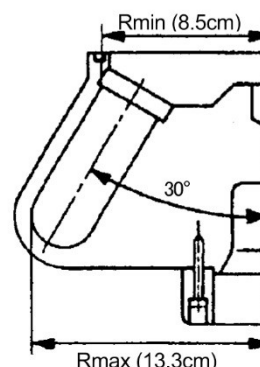
(2) Characteristics (when using the 250PP bottles)

Rotor speed (rpm)	RCF (xg)		K factor
	R=Rmin (5.5cm)	R=Rmax (13.8cm)	
2,000	246	617	58,255
4,000	984	2,240	14,564
6,000	2,210	5,550	6,473
8,000	3,940	9,870	3,641
10,000	6,150	15,400	2,330
12,000	8,850	22,200	1,618
14,000	12,100	30,240	1,189

5.4 R14A3 rotor

(1) Specifications

Maximum speed	·	14,000rpm
Maximum RCF	·	29,100×g
Tube capacity	·	80mL×10 * (Actual capacity of 80PA bottle: 60 mL)
Tube size	·	φ 3.8cm×10.4cm
Tube angle	·	30°
Rotor weight	·	12.9kg
Rotor number	·	44



(2) Characteristics (when using the 80PA bottles)

*When using the 94PA seal tubes (Part No. S304301A), the total capacity is 1000 mL as the capacity of a tube is 100 mL.

Use of the 94PA seal tubes requires the F3 space cap (Part No. S407754), the tube sealer, and the tube rack.

When using the Tube sealer (STF3 or STF2), the Tube rack (F2) (Part No.S201778M) is needed.

When using the Tube sealer (STF-1), the Tube rack (F) (Part No.S201778D) is needed.

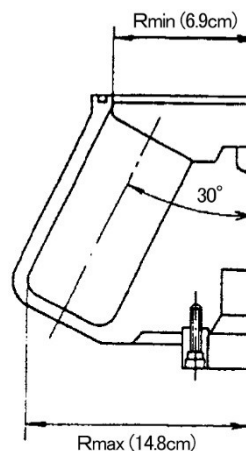
The F3 space cap is made of PP (polypropylene).

Rotor speed (rpm)	RCF (xg)		K factor
	R=Rmin (8.5cm)	R=Rmax (13.3cm)	
2,000	380	595	28,351
4,000	1,520	2,380	7,088
6,000	3,420	5,350	3,150
8,000	6,080	9,520	1,772
10,000	9,500	14,900	1,134
12,000	13,700	21,400	788
14,000	18,600	29,100	579

5.5 R12A3 rotor

(1) Specifications

Maximum speed	·	12,000rpm
Maximum RCF	·	23,800×g
Tube capacity	·	250mL×6 (Actual capacity of 250PP bottle: 250 mL)
Tube size	·	φ 6.2cm×13.2cm
Tube angle	·	30°
Rotor weight	·	16.0kg
Rotor number	·	41



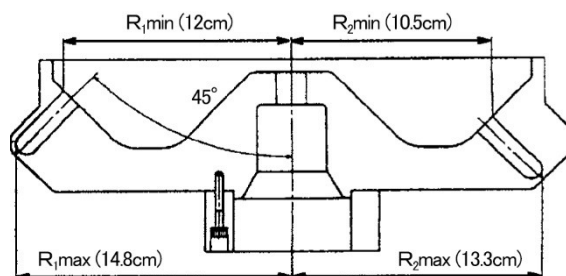
(2) Characteristics (when using the 250PP bottles)

Rotor speed (rpm)	RCF (xg)		K factor
	R=Rmin (6.9cm)	R=Rmax (14.8cm)	
2,000	309	662	48,324
4,000	1,230	2,650	12,081
6,000	2,780	5,960	5,369
8,000	4,940	10,600	3,020
9,000	6,250	13,400	2,386
10,000	7,710	16,500	1,933
11,000	9,330	20,000	1,597
12,000	11,100	23,800	1,342

5.6 R12A4 rotor

(1) Specifications

Maximum speed	· 12,000rpm
Maximum RCF	··· 23,800×g
Tube capacity	··· 2mL×72
Tube size	····· ϕ 1.1cm×4.1cm
Tube angle	····· 45°
Rotor weight	····· 7.7kg
Rotor number	····· 48



⚠ CAUTION:
Be sure to mount the rotor cover to the rotor and tighten the cover handle securely before operation.

(2) Characteristics

<Outside>

Rotor speed (rpm)	RCF (xg)		K factor
	R=Rmin (12cm)	R=Rmax (14.8cm)	
2,000	537	662	13,281
4,000	2,150	2,650	3,320
6,000	4,830	5,960	1,476
8,000	8,590	10,600	830
9,000	10,900	13,400	656
10,000	13,400	16,500	531
11,000	16,200	20,000	439
12,000	19,300	23,800	369

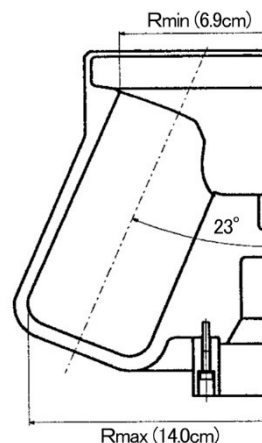
<Inside>

Rotor speed (rpm)	RCF (xg)		K factor
	R=Rmin (10.5cm)	R=Rmax (13.3cm)	
2,000	470	595	14,969
4,000	1,880	2,380	3,742
6,000	4,230	5,350	1,663
8,000	7,510	9,520	936
9,000	9,510	12,000	739
10,000	11,700	14,900	599
11,000	14,200	18,000	495
12,000	16,900	21,400	416

5.7 R12A6 rotor

(1) Specifications

Maximum speed	· 12,000rpm
Maximum RCF	··· 22,500×g
Tube capacity	··· 500mL×4 (Actual capacity of 500PA bottle: 390 mL)
Tube size	····· ϕ 7.3cm×16.3cm
Tube angle	····· 23°
Rotor weight	····· 14.8kg
Rotor number	····· 49



(2) Characteristics (when using the 500PA bottles)

Rotor speed (rpm)	RCF (xg)		K factor
	R=Rmin (6.9cm)	R=Rmax (14.0cm)	
2,000	309	626	44,805
4,000	1,230	2,500	11,201
6,000	2,780	5,630	4,978
8,000	4,940	10,000	2,800
9,000	6,250	12,700	2,213
10,000	7,710	15,700	1,792
11,000	9,330	18,900	1,481
12,000	11,100	22,500	1,245

⚠ CAUTION:
Be sure to mount the rotor cover to the rotor and tighten the cover handle securely before operation.

6. Standard accessories and optional accessories

6.1 Standard accessories of rotors

Rotor	Tube/bottle and cap		Others			Optional tube/bottle and cap		
	Name	Q'ty	Part No.	Name	Q'ty	Part No.	Name	Q'ty
R21A	11PA thick-walled tube	16				333959A	11PA thick-walled tube	10
	C2-PP lid	16				328478A	C2-PP lid	20
R14A	250PP bottle	4	455650A	Rotor set handle	1	S306749A	250PP bottle ass'y	10
	250 cap	4	84550301	Bottle setter	1	S409936A	250 cap ass'y	2
R14A3	80PA bottle ass'y	1(10)	84550301	Bottle setter	1	332094A	80PA bottle ass'y	10
R12A3	250PP bottle	6	455650A	Rotor set handle	1	S306749A	250PP bottle ass'y	10
	250 cap	6	84550301	Bottle setter	1	S409936A	250 cap ass'y	2
R12A6	500PA bottle ass'y	1(4)	455650B	Rotor set handle	1	330437A	500PA bottle ass'y	4

*Note that the R12A4 rotor does not include standard accessory tubes.

Purchase applicable tubes for these rotors referring to "2.1.2 Tubes for rotors requiring commercial tubes".

6.2 Optional accessories of rotors



84550301 Bottle setter
(1 pc.)



455650A Rotor set handle
(1 pc.) For R14A and R12A3

455650B
(1 pc.) For R12A6

Packing (1 pc.)



S400974 For R21A
4556553 For R14A
436845 For R12A3 and R14A3
474067 For R12A6



S301333 Cleaning rod
(1 pc.)



84810601 Lubricant for screw
(1 pc.)



S413837 Silicone grease (vacuum grease)
(1 pc.)



349981A Balancer (500 g) (For R14A, R12A3 and R12A6)

7. Decontamination



WARNING:

- If the centrifuge, rotor or an accessory is contaminated by samples that are toxic or radioactive, or blood samples that are pathogenic or infectious, be sure to decontaminate the item according to good laboratory procedures and methods.
- If there is a possibility that the rotor or an accessory is contaminated by samples that might impair human health (for example, samples that are toxic or radioactive, or blood samples that are pathogenic or infectious), it is your responsibility to sterilize or decontaminate the rotor or the accessory properly before requesting repairs from an authorized sales or service representative. Note that we cannot repair the centrifuge, rotor or the accessory unless sterilization or decontamination is completed.
- It is your responsibility to sterilize and/or decontaminate the rotor or parts properly before returning them to an authorized sales or service representative. In such cases, copy the attached decontamination sheet and fill out the copied sheet, then attach it to the item to be returned. We may ask you about the treatment for the rotor or parts if the decontamination is checked and judged as insufficient by us. It is your responsibility to bear the cost of sterilization or decontamination. Note that we cannot repair or inspect the rotor or the accessory unless sterilization or decontamination is completed.

8. Rotor retirement

After many years of use, there will be inevitably some corrosion or stress corrosion. At some points, the combination of such damage and metal fatigue could make the rotor vulnerable to a failure. Although a rotor may appear to be in a good condition, you should follow the rotor retirement recommendation shown below.

Rotor	Material	Retire After Years
Refrigerated centrifuge rotors	Aluminum alloy	15
	Stainless steel	

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