

Keep this rotor instruction manual and the centrifuge manual in the file.

## Angle Rotor for Refrigerated Centrifuge

# R20A2

(Serial No. 4001 or later)

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

### Contents



1. Specifications	_____	1
2. Tubes/Bottles	_____	3
3. How to use	_____	6
4. Maintenance	_____	8
5. Packing list	_____	10
6. Spare parts	_____	10
7. Decontamination	_____	11
8. Rotor retirement	_____	11
(Appendix) K Factors	_____	12







## 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**

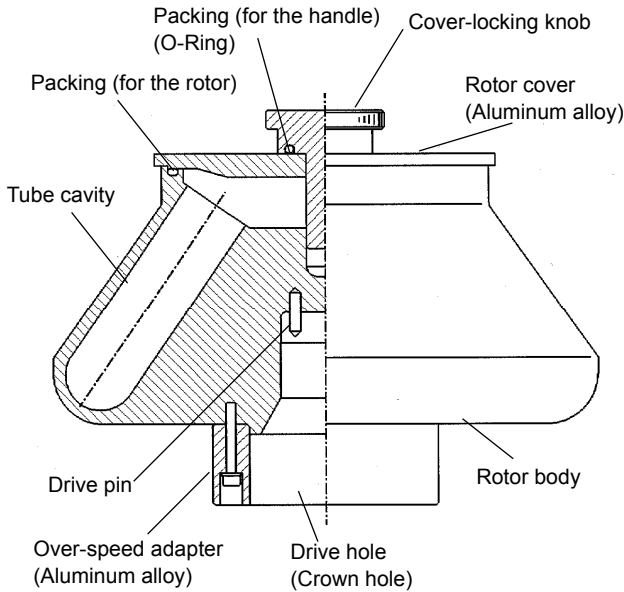
- Never use any material capable of producing flammable or explosive vapors.
- Your centrifuge and rotor are not designed to confine any sample particles dispersed due to leakage. Therefore, when using toxic or radioactive samples or pathogenic or infectious blood samples, make sure to prepare necessary 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.

# 1. Specifications

## 1.1 Construction



R20A2: Material of the cover-locking knob: Stainless steel  
 R20A2: Material of the rotor body: Aluminum alloy  
 R20A2: Material of the packing (for the handle) (O-Ring): Fluorine-contained rubber  
 R20A2: Material of the packing (for the rotor): Nitrile rubber

Figure1-1 Construction of the angle rotor

## 1.2 Specifications

### Applicable centrifuge\*1

(Some centrifuges are on sale in only Japan. Visit our web site.)

Max. speed\*2: 20,000 rpm  
 Max. RCF: 48,000 × g  
 Nominal rotor capacity: 50 mL × 8 tubes = 400 mL  
 Rotor Size: φ 225 × 163.7 mm  
 Weight: 6.8 kg  
 Material: Aluminum alloy  
 Rotor No.: 46

\*1: For applicable centrifuges, refer to the “Applicable centrifuges (Rotors for high-speed refrigerated centrifuges) (Part No. S998611)”.

\*2: The maximum allowable speed varies with centrifuge models and so on. For further details, refer to the “Applicable centrifuges (Rotors for high-speed refrigerated centrifuges) (Part No. S998611)”.

## 1.3 Cross-sectional view of rotor

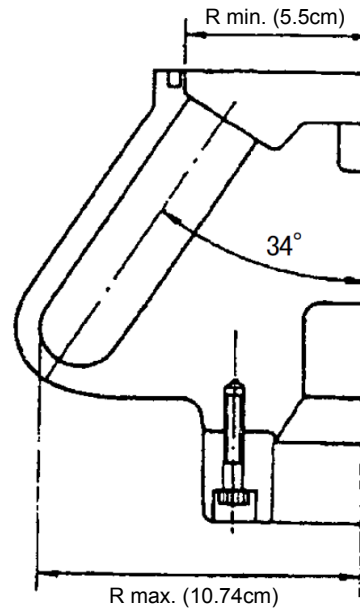


Figure1-2 Cross-sectional view of R20A2 rotor

## 1.4 Characteristic of rotor

Table1-1 Characteristics (when 50PA tubes are used)

Rotor speed (rpm)	RCF (×g)		K factor*
	Rmin. (5.5cm)	Rmax. (10.74cm)	
2,000	246	480	42,379
4,000	984	1,920	10,595
6,000	2,210	4,320	4,709
8,000	3,940	7,680	2,649
10,000	6,150	12,000	1,695
12,000	8,850	17,300	1,177
14,000	12,100	23,500	865
16,000	15,700	30,700	662
18,000	19,900	38,900	523
20,000	24,600	48,000	424

\*For details about K factor, refer to “(Appendix) K Factors”

Calculation formula

$$RCF = 1.118 \times 10^{-5} \times R \times N^2 (\times g)$$

R: Rotating radius (cm)

N: Speed (rpm)

## 1.5 Allowable speed of the rotor



### WARNING :

Do not exceed the maximum speed of the rotor. The rotor speed should be limited depending on sample characteristic, kinds of tubes/bottles 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 tubes/bottles and centrifuge model, the rotor speed may be limited as follows. Do not exceed the allowable speed of the rotor.

### (1) Allowable speed for sample density



### WARNING :

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

$$\text{Allowable speed (rpm)} = 20,000(\text{rpm}) \times \sqrt{\frac{1.2(\text{g/mL})}{\text{Average density of sample}(\text{g/mL})}}$$

### (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, refer to “2.2 Applicable tubes/bottles”.

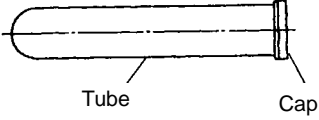
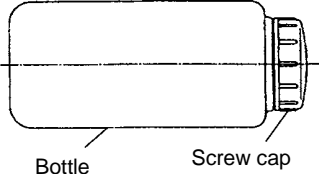
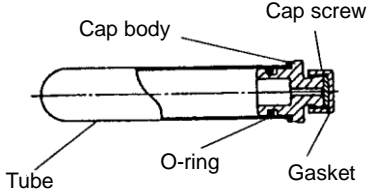
Perform operation under the allowable speed, otherwise tubes/bottles may be broken during operation.

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

## 2. Tubes/Bottles

### 2.1 Kinds of tubes and bottles

Following table shows general types of tubes and bottles.

Simplified types		Seal-capped type
<p>(A) Tube system</p>  <p style="text-align: center;">Tube                  Cap</p>	<p>(B) Bottle system</p>  <p style="text-align: center;">Bottle                  Screw cap</p>	<p>(C) Tube system</p>  <p style="text-align: center;">Tube                  O-ring                  Gasket</p> <p style="text-align: center;">Cap body                  Cap screw</p>

Tubes and bottles are made of the following materials.

**PC: Polycarbonate**

Strong, transparent and can be autoclaved at 121°C or less. Use the tubes/bottles at a temperature between 4 °C and 25 °C. Weak in organic solution, alkali solution, and alkali detergent.

**PE: Polyethylene**

Opaque. Can not be autoclaved. Excellent in chemical resistance.

Use the tubes/bottles at a temperature between 4 °C and 20 °C.

**PP: Polypropylene**

Strong but susceptible to low temperature (brittle point:0°C). It can be autoclaved at 121°C or less.

Use the tubes/bottles at a temperature between 4 °C and 25 °C.

**PA: Polypropylene copolymer**

Strong and can be autoclaved at 115°C or less. Use the tubes/bottles at a temperature between 4 °C and 25 °C.

**SST: Stainless steel**

Excellent in chemical resistance and heat resistance. It can be autoclaved at 121°C or less.

**Glass:** It is transparent and highly heat-resistant.

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

## 2.2 Applicable tubes/bottles

Table2-1 Applicable tubes/bottles


Tubes/Bottles				Tube Adapter				Cap		Max. speed (rpm)	Max. RCF (xg)
Part No. (Qty)	Name	Size (φ XL cm)	Actual capacity (mL/tube)	Part No. (Qty)	Name	Size (φ XL cm)	Material * 2	Part No. (Qty)	Name		
328353A (10 pcs.)	50PA Tube	2.9 X 10.4	38	---	---	---	---	328479A (20 pcs.)	M-PP Lid	20,000	48,000
328354A (10 pcs.)	50PC Tube	2.9 X 10.3	36	---	---	---	---	328479A (20 pcs.)	M-PP Lid	20,000	48,000
S306352A (10 pcs.)	50PP Bottle Ass'y	2.9 X 10.3	34	---	---	---	---	---	---	20,000	48,000
328352A (10 pcs.)	50PC Bottle Ass'y	2.9 X 10.3	36	---	---	---	---	---	---	20,000	48,000
328342A (2 pcs.)	50SST Tube	2.9 X 10.2	41	---	---	---	---	---	Capless	20,000	48,000
Marketed	1.5mL Microtube * 1	1.1 X 3.9	1.5	S407652A (2 pcs.)	1.5X2A50 Adapter	2.8 X 10.0	POM	---	---	15,000	18,300
464977A (50 pcs.)	10 GlassTube	1.2 X 10.5	7.4	336712A (8 pcs.)	10GA50 Adapter	2.8 X 10.1	NBR	---	Capless	4,000	1,810
325470A (50 pcs.)	12PE Tube	1.6 X 7.5	9.8	S413527A (2 pcs.)	11A50 Adapter (C)	2.9 X 9.8	PP	424916A (1 pc.)	C2-AL Cap Ass'y	15,000	23,300
329606A (50 pcs.)	12PA Tube	1.6 X 7.6	9.9	S413527A (2 pcs.)	11A50 Adapter (C)	2.9 X 9.8	PP	424916A (1 pc.)	C2-AL Cap Ass'y	15,000	23,300
325751A (50 pcs.)	12PC Tube	1.6 X 7.6	10.3	S413527A (2 pcs.)	11A50 Adapter (C)	2.9 X 9.8	PP	424916A (1 pc.)	C2-AL Cap Ass'y	15,000	23,300
326010A (2 pcs.)	12SST Tube	1.6 X 7.6	10.7	S413527A (2 pcs.)	11A50 Adapter (C)	2.9 X 9.8	PP	424916A (1 pc.)	C2-AL Cap Ass'y	15,000	23,300
325952A (10 pcs.)	10PC Bottle Ass'y	1.6 X 8.2	8.2	S413527A (2 pcs.)	11A50 Adapter (C)	2.9 X 9.8	PP	---	---	15,000	23,300
333959A (10 pcs.)	11PA Thick-Walled Tube	1.6 X 8.2	8.0	S413527A (2 pcs.)	11A50 Adapter (C)	2.9 X 9.8	PP	328478A (20 pcs.)	C2-PP Lid	15,000	23,300
326607A (10 pcs.)	11PC Thick-Walled Tube Ass'y	1.6 X 8.3	8.4	S413527A (2 pcs.)	11A50 Adapter (C)	2.9 X 9.8	PP	---	---	15,000	23,300

\*1: When using tubes on the market, perform operation under the allowable speed or the allowable RCF specified by the manufacturer. Otherwise the tubes may be broken during operation.

\*2: Material: POM: Polyacetal NBR: Nitrile rubber PP: Polypropylene

The maximum allowable speed varies with centrifuge models and so on. For further details, refer to the "Applicable centrifuges (Rotors for high-speed refrigerated centrifuges (Part No. S998611))".

The rotor speed is limited by the sample density and so on (see Section1.5).

 **CAUTION:**  
When using bottles/tubes outside 4-25°C, bottles/tubes may be broken or deformed during operation. Test them before actual operation and perform actual operation after checking that there is no inconvenience such as the above.

- Maximum speeds listed are guidelines only. Because of variances in user methodologies, no guarantee of performance is expressed or implied.



### 2.3 Washing and sterilization of tubes/bottles

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

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

•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/bottles 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.

• 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 or 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.


 **CAUTION:**  
Do not place the screw caps or lids on the mouths of the tubes/bottles. Otherwise the tubes/bottles may be deformed or damaged during autoclaving.

Table 2-2 Washing and sterilization of tubes/bottles

✓: Applicable ✗: Inapplicable

Condition		Material	PE	PA	PC	PP	SST
Cleaning	Cleaning fluids	pH5 or lower	✗	✗	✗	✗	✗
		pH5 to pH9	✓	✓	✓	✓	✓
		pH9 or higher	✓	✓	✗	✓	✓
		Warm water (up to 50°C)	✓	✓	✓	✓	✓
	Ultrasonic cleaning	Neutral detergent (pH7)	✓	✓	✓	✓	✓
Sterilization	Autoclaving	115°C (0.7kg/cm <sup>2</sup> ), 30 minutes	✗	✓	✓	✓	✓
		121°C (1.0kg/cm <sup>2</sup> ), 20 minutes	✗	✗	✓	✓	✓
		126°C (1.4kg/cm <sup>2</sup> ), 15 minutes	✗	✗	✗	✗	✗
	Boiling	For 15 to 30 minutes	✗	✓	✓	✓	✓
	Ultraviolet sterilization	200-300nm	✗	✗	✗	✗	✓
	Gas sterilization	Ethylene oxide	✓	✓	✗	✓	✓
		Formaldehyde	✓	✓	✓	✓	✗
	Chemical	Ethanol (70%)	✓	✓	✗	✓	✓
		Hydrogen peroxide (3%)	✓	✓	✓	✓	✓
Formalin (3%)		✓	✓	✓	✓	✗	

PE: Polyethylene PA: Polypropylene copolymer PC: Polycarbonate

PP: Polypropylene SST: Stainless steel

### 2.4 Life expectancy of plastic tubes/bottles

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

- (1) Tubes (PA, PP, PC, and PE) ..... 5 times
- (2) Thick-walled tubes and bottles (PA, PP, PC, and PE) ..... 50 times
- (3) Tubes on the market ..... 1 time

However, the standard lives of the PC thick-walled tubes and PC bottles are specified as follows depending upon the pre-treating conditions such as washing, sterilization, etc.:

Table 2-3 Standard Lives of the PC thick-walled tubes and PC bottles

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

The standard life of a plastic tube/bottle as the above is an approximate guide when it is used repeatedly for 1 hour at the maximum speed of rotor. We do not warrant the life expectancies of tubes/bottles.

Do not use crazed (cracked) tubes or bottles.

### 3. How to use

#### 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.

**⚠ WARNING :**

- This rotor 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.

**⚠ 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/bottles 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.
- Use the samples that are same in compositions and same in density when placing them symmetrically. Otherwise the precipitation levels may be different by centrifugation and such operation may increase the level of imbalance, and it may result in damage to the centrifuge and the rotor.

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

(1) Simplified type

Inject the samples into the tubes/bottles and cap the tubes/bottles properly. Do not exceed the specified sample capacity of the tubes/bottles, otherwise sample leakage or deformation of tubes/bottles may occur.

Balance the tubes/bottles that are symmetrically arranged. The allowable imbalance of this rotor is within 2 g.

(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 a sample and push the cap body in. Inject a sample into the tube with a syringe through the small hole to fill the tube to the capacity. Do not exceed the allowable imbalance between the tubes symmetrically arranged in the rotor with respect to the drive shaft. The allowable imbalance of this rotor is within 2 g. 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).

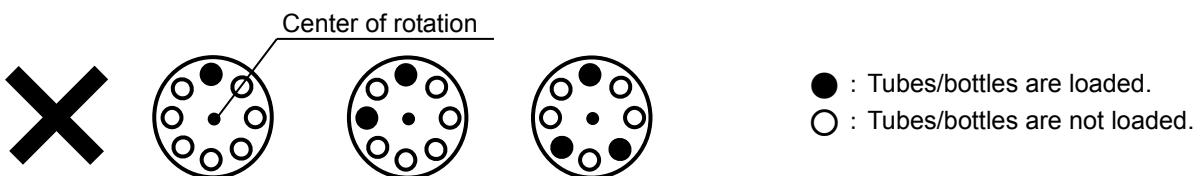
The weight is engraved on the body. Set the two stainless steel tubes in the rotor symmetrically with respect to the drive shaft.

#### 3.2 Setting of tubes/bottles into 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. Pre-cool the rotor when the operating temperature of the rotor is lower than the room temperature or pre-heat the rotor when the operating temperature of the rotor is higher than the room temperature before setting the tubes/bottles in the rotor. Examples of incorrect tube/bottle setting are shown below.



### 3.3 Mounting the rotor cover

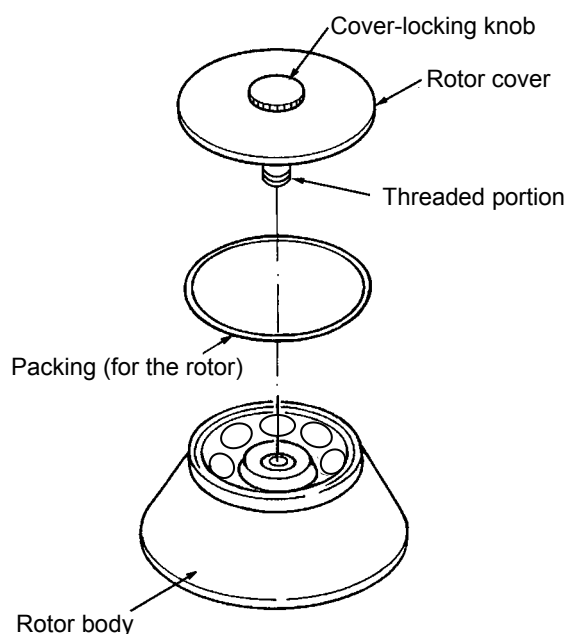
**⚠ CAUTION:**

- Be sure to mount the rotor cover to the rotor body and tighten the cover locking knob 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.
- Do not mount the rotor cover into the rotor while the rotor is placed in the rotor chamber. Doing so might cause the rotor cover to be tightened insufficiently.  
Do not remove the rotor cover from the rotor while the rotor is placed in the rotor chamber. Doing so might cause the parts of the rotor cover to be damaged.

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

If you neglect to apply silicone grease (vacuum grease), it might be hard to mount or remove the rotor cover. When it is hard to mount or remove the rotor cover, apply silicone grease (vacuum grease) to the packing (for the rotor).

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



### 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-locking knob 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 locking knob. Take out the tubes/bottles from the rotor and then take out the sample in a proper manner.

## 4. Maintenance

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### 4.1 Corrosion resistance of rotor



**WARNING:**

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

This rotor is made of aluminum alloy. 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 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.

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



**WARNING :**

Do not allow the rotor temperature to rise over 100°C. Otherwise, the rotor can be brittle.



**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 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.

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#### 4.3 Sterilizing rotor

Sterilize this rotor and the rotor cover in any following methods; autoclaving(121°C, 20minutes), 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).



##### WARNING:

- Never sterilize the rotor whose serial number is 4000 or earlier by autoclaving.
- Be sure to remove the rotor cover from the rotor before autoclaving, otherwise the rotor and the rotor cover may be deformed.
- Never sterilize the rotor and the rotor cover by boiling, otherwise they will be brittle.



##### CAUTION:

- After autoclaving, wait until the temperature in the autoclaving chamber is the same as the room temperature and then take out the rotor and the rotor cover.
- Take out the rotor and the rotor cover carefully from the autoclaving chamber as they are wet and slippery.
- Inspect the packing (for the rotor) after sterilization. If you observe that the packing (for the rotor) is damaged and is deteriorated, replace it with the new one.
- Do not soak the rotor and the rotor cover in chemicals. Failure to do so can cause the rotor to be damaged due to the remaining liquid inside of the rotor.
- Never sterilize the adapters by autoclaving or boiling. Otherwise, the adapters may be deformed. Such adapters cannot be used.

#### 4.4 Inspecting rotor

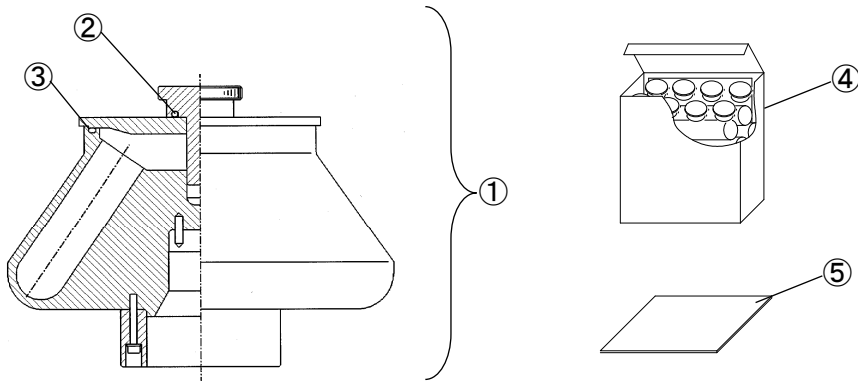
Periodically check that the rotor is free from corrosion every 100 hours use. Especially be careful of the tube cavities of the rotor and the crown hole at the rotor bottom because the rotor can be brittle if these portions are corroded. If the rotor surface is discolored, dented or cracked, the rotor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

## 5. Packing list


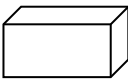



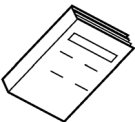
Check the parts and accessories of the rotor when the rotor is delivered. Contact an authorized sales or service representative if there are a missing item and inferior goods.

No.	Name	Qty	Remark
①	Rotor	1	—
②	Packing (for the handle) (O-Ring)	1*	—
③			
④	50 PA tube Ass'y	1	50 PA tube: 8 pcs. M-PP lid: 8 pcs.
⑤	Rotor instruction manual	1	Part No. S998257

\*: the quantities of the parts that are mounted to the rotor



## 6. Spare parts

	PART No.	Name	Qty
	84521017	Packing (for the handle) (O-Ring)	3
	S409675A	Packing (for the rotor)	3
	328353A	50PA tube	10
	328479A	M-PP lid	20
	84810601	Lubricant for screw	1
	483719	Silicone grease (vacuum grease)	1
	S998257	Rotor Instruction manual	1

## 7. Decontamination

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### 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

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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	

## (Appendix) K Factors

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- Calculation of separation time

The K factor can conveniently be used which makes it possible to estimate the settling time directly from Svedberg unit(S).

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.

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

$\omega$  : Angular velocity  $\omega = 2\pi/60 \times N$

N : Speed (rpm)

Rmin. : Distance from axis of rotation to top of solution (cm )

Rmax. : Distance from axis of rotation to bottom of tube (cm )

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

$$t = \frac{K}{S}$$

For example, the K factor at the maximum speed of 20,000rpm of Model R20A2 rotor is 424. The time taken for particles of 100 S to be settled from Rmin. to Rmax. using this rotor is as follows:

$$t = \frac{424}{100} = 4.2 \text{ hours}$$

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

$$K = \left( \frac{20,000}{15,000} \right)^2 \times 424 = 754 \quad t = \frac{754}{100} = 7.5 \text{ hours}$$



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# MEMO

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