INSTRUCTION MANUAL

himac
EPPENDORF GROUP

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

ROTORS AND TUBES

FOR Micro Ultracentrifuge

This manual contains instruction for operation of Angle rotor, Neo-angle rotor, Vertical rotor and Swing rotor. Carefully read this manual in conjunction with manual for centrifuge and use the rotor correctly. Retain it for future reference after reading.

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Original instruction manual

○ The contents in this manual are subject to change for improvement.

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ABOUT ⚠ MARKS

In this manual, ⚠ marks are used to make attention, to prevent personal injury or machine damage. The meaning of the mark is 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.

SAFETY REMINDER

Centrifuge rotors rotating at high speed have considerable potential for damage to personal properties if used improperly. This is also true with your micro ultracentrifuge rotors. To ensure safe operation of your ultracentrifuge, you should read thoroughly rotor instruction manual and, also, should keep in mind the following cautionary information;

⚠WARNING

- ◆ Never use any material capable of producing flammable or explosive vapors.
- ◆ Your micro ultracentrifuge 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 both the bottom and cover of rotor). And under same conditions which the rotor and/or the tube is overstressed, the maximum speed of the rotor must be reduced. DO NOT exceed this allowable speed.
- ◆ Check the chemical resistance chart attached the rotor, and do not use any sample inapplicable to the rotor: Using such a sample could corrode the rotor.
- ◆ Do not allow the temperature of the rotor to rise above 100°C because otherwise the material would become brittle.
- ◆ Never autoclave the rotor or sterilize it in boiling water: The strength of rotor may be significantly lost.
- ◆ If the 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.
- ◆ It is your responsibility to sterilize and/or decontaminate the rotor or parts properly before returning them to an authorized sales or service representative.

⚠CAUTION

- ◆ Check the chemical resistance chart attached to the rotor, and do not use any sample inapplicable to the tubes, bottles, adapters, tube caps, bottle caps, etc. Using such a sample could corrode or deteriorate such parts.
- ◆ Balance the sample in the tubes within the allowable imbalance of the rotor. Serious imbalance can cause damage to the drive spindle of the ultracentrifuge and to the drive hole in the rotor.
- ◆ Tighten the screw certainly such as the rotor cover, the bucket cap, etc.
- ◆ When using swing rotor, be sure to set all buckets of the same type whether or not samples are put in buckets: Failure to do so could not only cause the rotor to vibrate, but could result in the rotor being deformed and the buckets becoming detached, which is very dangerous.
- ◆ The rotors is classified the two types, quick-setting type and screw setting type, by the difference of the method of the installation on the centrifuge. The available centrifuge for them is different respectively. Confirm which type of the rotor can be used on your centrifuge.
- ◆ Even a quick-setting type rotor cannot be used with some centrifuges: Use a centrifuge that is compatible with the rotor.
- ◆ In case of the screw-setting type rotor, fasten it to the centrifuge certainly.
- ◆ Be careful that the cover of the quick-setting type angle rotor has a sharp pin.
- ◆ When the rotor is not used, be sure to set it on the rotor stand.
- ◆ Do not load only one tube or load tubes asymmetrically: Asymmetrical loading may cause imbalance operation and damage the centrifuge and rotor.
- ◆ Clean the inside of drive hole (crown hole) in the rotor and the surface of drive shaft (crown) of centrifuge once a month. If the drive hole or drive shaft is stained or if any foreign matter adheres, the rotor may have been improperly installed and could come off during operation.
- ◆ 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.
- ◆ Perform maintenance and inspection of the rotor each time after using it. If you find any abnormality in the rotor, stop using it and contact an authorized sales or service representative.

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1. Rotors

1.1 Kinds of rotors and available centrifuge

The rotors can be classified Angle rotors, Neo-angle rotors, Swing rotors and Vertical rotors by their shape.
Choose the rotor in the use purpose reading this chapter and appendix 2.
The rotors are classified two types (quick-setting type and screw-setting type) by the difference of the method of the installation on the centrifuge.

Quick-setting type	The rotor need not be fixed to the centrifuge. It is possible to use only by putting the rotor on the drive spindle of the centrifuge.
Screw-setting type	The rotor must be fixed to the drive spindle of the centrifuge by tightening screw.

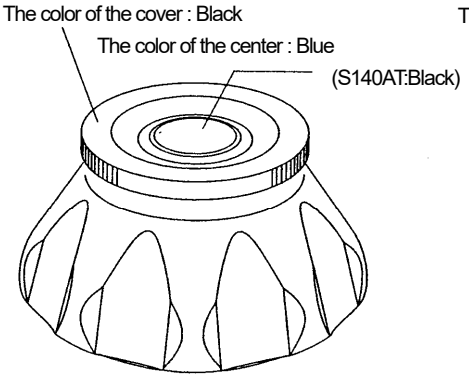
Therefore, the available centrifuge might be different even if its model name is the same. See Fig. 1-1, confirm which type rotor can be used on your centrifuge.

⚠ CAUTION

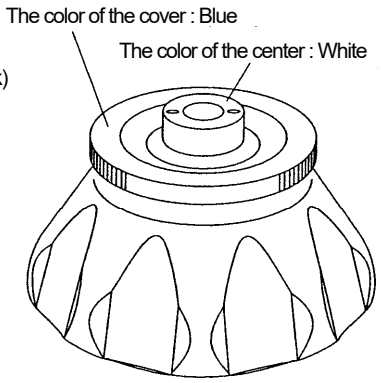
Use the rotor with the available centrifuge for it correctly. Using by a wrong combination can cause damage for the centrifuge and/or the rotor.

Table 1-1 Available centrifuge

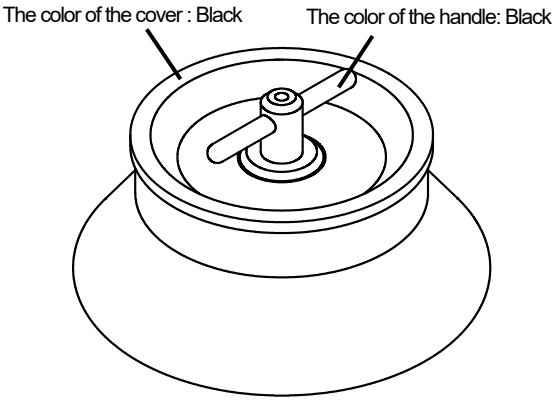
Type of rotor	Available centrifuge ※The model of the product in parentheses is that of discontinued product.
Quick-setting type	CS150NX CS150FNX, CS120FNX (CS150GXⅡ), (CS120GXⅡ) (CS150GXL), (CS120GXL) (CS150GX), (CS120GX)
Screw-setting type	(CS120FX), (CS100FX), (CS120EX), (CS100EX) (CS120), (CS100), (CP120H), (CP100H)



(a) Quick setting type rotor



(b) Screw-setting type rotor



(a) Quick setting type rotor（S58A, S55A2, S50A）

Fig. 1-1 Appearance of the rotor

1.2 Angle rotors

Angle rotors, which generally called fixed angle rotor, hold the tubes at an angle to the axis of rotation. It is mainly used to separate components in a cell by fractional centrifugation (pelleting) and separate nucleic acid by isopycnic centrifugation. Fig. 1-2 shows the appearance and part names of angle rotor, and Table 1-2 shows the specifications of angle rotors.

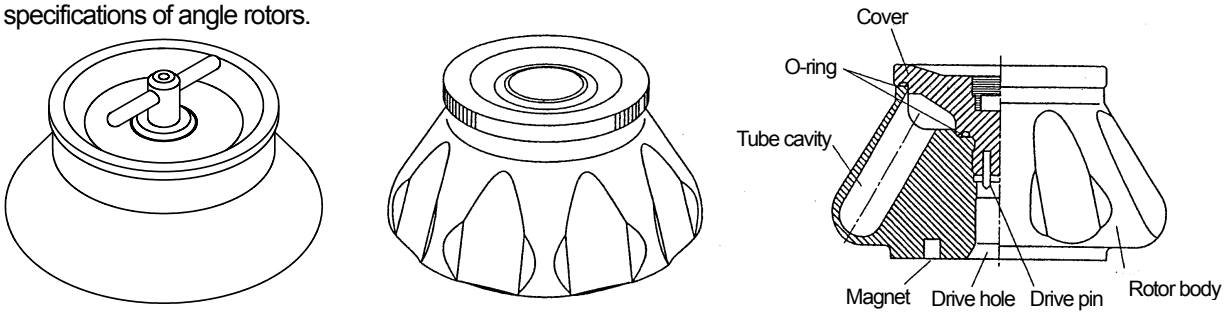


Fig. 1-2 Appearance and part names of quick-setting type angle rotor

Table 1-2 Specifications of angle rotors *Nominal capacity

Rotor	Maximum speed (rpm)	Maximum RCF (× g)	κ factor	Tube* (number × mL)	Rotor capacity* (mL)	Weight (kg)	Rotor body material	Cover material
S150AT	150,000	901,000	6	8 × 1.0 mL	8.0	0.4	Titanium alloy	Aluminum alloy
S140AT	140,000	1,050,000	5	10 × 1.0 mL	10.0	0.8		Titanium alloy
S120AT2	120,000	650,000	8	10 × 1.0 mL	10.0	0.5		Aluminum alloy
S120AT3	120,000	650,000	8	14 × 0.5 mL	7.0	0.6		
S110AT	110,000	691,000	15	8 × 4.0 mL	32.0	1.2		
S100AT3	100,000	436,000	7	20 × 0.23 mL	4.6	0.5		
S100AT4	100,000	541,000	16	6 × 3.0 mL	18.0	1.1		
S80AT2	80,000	358,000	14	30 × 0.5 mL	15.0	1.0		
S80AT3	80,000	415,000	23	8 × 6.0 mL	48.0	1.5		
S70AT	70,000	307,000	31	20 × 0.5 mL	10.0	1.4		
S58A	58,000	289,000	50	8 × 13.5 mL	108	1.9	Aluminum alloy	
S55A2	55,000	201,000	40	12× 1.5 mL	18.0	0.8		
S50A	50,000	210,000	61	6× 30.0 mL	180	1.8		

1.3 Neo-angle rotors

Neo-angle rotor holds the tubes at a smaller angle to the axis of rotation than the angle rotors. It is effective to separate samples that produce precipitation and floating matter such as plasmid DNA in a short time. Fig. 1-3 shows the appearance and part names of neo-angle rotor, and Table 1-3 shows the specifications of neo-angle rotors. (Neo-angle rotors are not sold in Europe and U.S.A.)

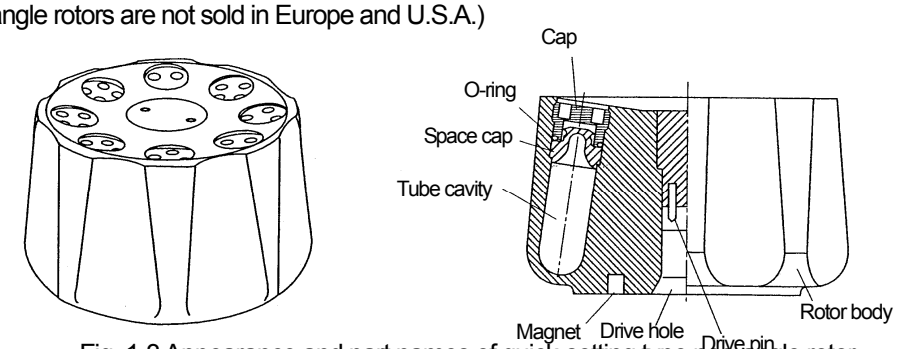


Fig. 1-3 Appearance and part names of quick-setting type neo-angle rotor

Table 1-3 Specifications of neo-angle rotors *Nominal capacity

Rotor	Maximum speed (rpm)	Maximum RCF (×g)	κ factor	Tube* (number × mL)	Rotor capacity* (mL)	Weight (kg)	Rotor body material	Cap material
S140NT	140,000	752,000	6	8×2.0 mL	16.0	0.5	Titanium alloy	Aluminum alloy
S120NT	120,000	586,000	9	8×2.0 mL	16.0	0.7		
S100NT	100,000	479,000	12	8×4.0 mL	32.0	1.1		

1.4 Swing rotors

Swing rotor, which generally called swinging bucket rotor, holds the tubes in the bucket and swings the buckets in the centrifugal direction. It is mainly used for high precision separation such as to separate components in a cell by rate-zonal centrifugation. Fig. 1-4 shows the appearance and part names of swing rotor, and Table 1-4 shows the specifications of swing rotor.

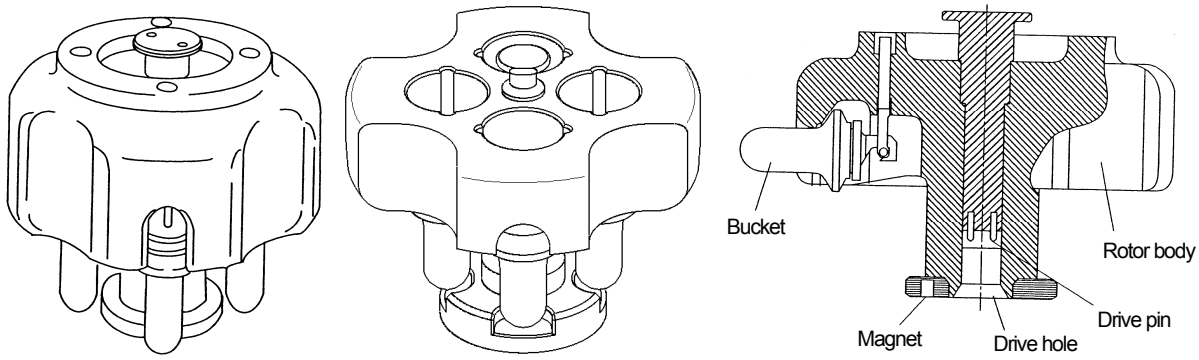


Fig. 1-4 Appearance and part names of quick-setting type swing rotor

Table 1-4 Specifications of swing rotor *Nominal capacity

Rotor	Maximum speed (rpm)	Maximum RCF (× g)	κ factor	Tube* (number × mL)	Rotor capacity* (mL)	Weight (kg)	Rotor body material	Bucket material
S55S	55,000	259,000	44	4 × 2.2 mL	8.8	1.2	Aluminum alloy	Titanium alloy
S52ST	52,000	276,000	79	4 × 5.0 mL	20.0	1.7	Titanium alloy	
S50ST	50,000	253,000	77	4 × 7.0 mL	28.0	1.8		

⚠ CAUTION

The S50ST and S52ST swing rotor can be used with the CS150NX, CS-FNX series, CS-GXⅡ series, and CS-GXL series, but they cannot be used with other centrifuges.
The ring-shaped projection at the bottom of S50ST and S52ST swing rotor is not a rotor stand: It secures the safety of rotor and centrifuge. Be careful not to damage or deform it when handling the rotor.

1.5 Vertical rotor

Vertical rotor, which generally called vertical tube rotor, holds the tubes perpendicularly to the centrifugal force. It is expected for separation on a shorter time with this rotor than with swing rotor and angle rotors. It is specially effective to separate nucleic acid by isopycnic centrifugation. Fig. 1-5 shows the appearance and part names of vertical rotor, and Table 1-5 shows the specifications of vertical rotor.

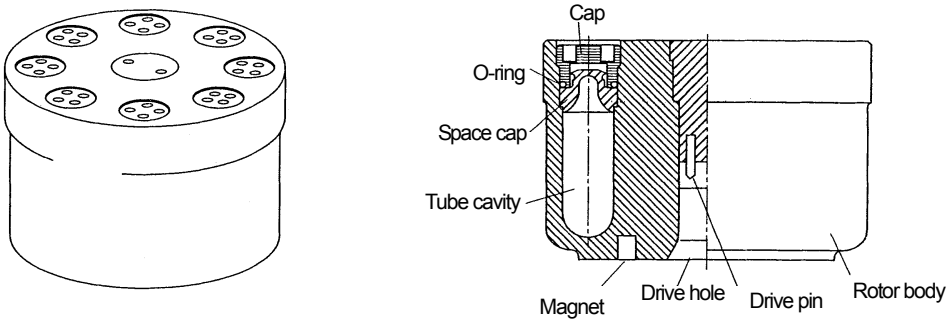


Fig. 1-5 Appearance and part names of quick-setting type vertical rotor

Table 1-5 Specifications of vertical rotor *Nominal capacity

Rotor	Maximum speed (rpm)	Maximum RCF (× g)	κ factor	Tube* (number × mL)	Rotor Capacity* (mL)	Weight (kg)	Rotor body material	Cap material
S120VT	120,000	501,000	8	8×2.0 mL	16.0	0.6	Titanium alloy	Aluminum alloy

2. Tubes, caps, and adapters

2.1 Types of tubes, caps, and adapters

● **Tubes**

⚠ CAUTION

When using tubes on the market, perform the operation under the allowable RCF specified by the manufacturer. Otherwise the tube may be broken during operation. Before using tubes/bottles on the market, test them by filling them with water instead of sample, and run them at the intended speed to ensure that there is no abnormality.

○ **Tubes (thin walled tubes)**

Tubes are used in swing rotor without caps. It is necessary to fill the tubes up to within 3-10mm from the top of tubes with the sample. These tubes (thin walled tubes) with cap can be used in the S50A, S58A, or S110AT rotor. When using the S50A or S58A rotor, you must fill up these tubes (thin walled tubes) with the sample.
However, stainless steel tubes and titanium alloy tubes can be used with optional volume less than net volume without caps.

○ **Thick-walled tubes**

Thick-walled tubes are used in angle rotors and swing rotor without caps. For angle rotors, these can be used with optional volume less than net volume. For swing rotor, fill the tubes up to within 3-10mm from the top of tubes with the sample.

○ **Seal tubes**

Seal tubes are sealed by heating and used with space caps in angle rotors, swing rotor, neo-angle rotors and vertical rotor. For some sealed tube and rotor combinations, a float spacer must be set before setting the space cap. These tubes must be filled up the sample. The tube sealer, model STF3/STF2/STF-1, and tube rack are necessary to seal tubes.

○ **Micro tubes on the market**

The micro tube is the tube with the cap and conical shape. 1.5mL micro tubes made of polypropylene can be used with the S110AT, S100AT4, and S80AT3 rotor with Adapters.
The S55A2 rotor is used without Adapters.
Micro Tube (Part No.S308892A) and Sampling Tube (84710901) are recommended when using micro tubes in the rotor manufactured by us.
Maximum RCF of Micro Tube (Part No.S308892A) is 201,000xg.
Maximum RCF of Sampling Tube (84710901) is 125,000xg.
Refer to the appendix 2 for the maximum speed of each rotor.

○ **Bottle (only for the S50A or S58A rotor)**

This bottle is used with screw cap for the S50A or S58A rotor. It can be used with any volume less than the net volume. (However, when a 20PA Bottle (C) is used at more than 100,000xg (maximum RCF), liquid should be over the shoulder of the bottle.)

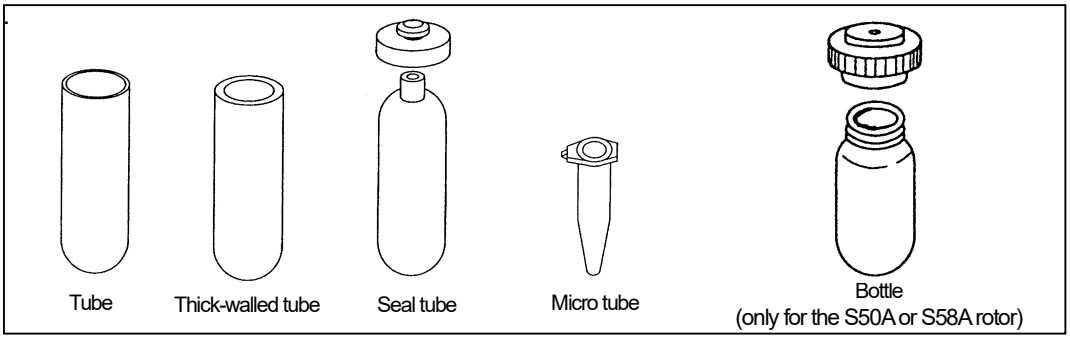


Fig. 2-1 Appearance of tubes

● **Caps, adapters, and float spacers**

○ **Space caps (for seal tubes)**

Space caps prevent deformation of seal tubes during operation and are made from aluminum alloy or modified polyphenylene ether. Be careful that different rotors use different space caps.

○ **Float spacers (for some seal tubes)**

Float spacers prevent deformation of seal tubes during operation and are made from modified polyphenylene ether. Be sure to use float spacers with space caps. Be careful that different rotors use different float spacers.

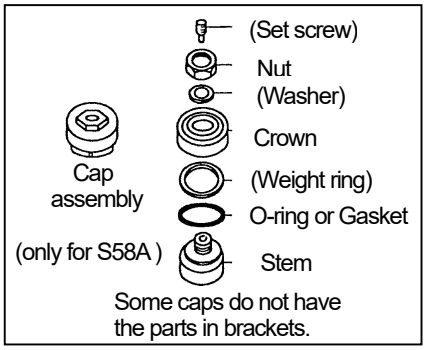


Fig. 2-2 Caps

○ **Adapters**

⚠ CAUTION

Adapters are consumables. Replace them with new ones if damage or deterioration (discolored surface, scratches, cracks, deformation, etc.) is found.

⚠ CAUTION

Do not operate the rotor with the adapters loaded into without the tubes, otherwise the adapters might deform by centrifugation.

Adapters are used when micro tubes are used with the S110AT, S100AT4, and S80AT3 rotor. Adapters are made from white polyacetal.

○ **Caps (for the S50A or S58A rotor)**

A Cap is used when a thin walled tube is used in the S50A or S58A rotor. Be careful that different caps have different assemblies (parts) and materials.

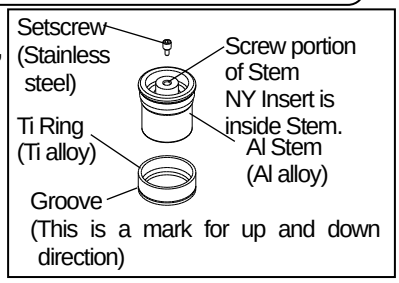


Fig. 2-3 S-Caps

○ **S-Caps (for the S50A or S58A rotor)**

The composition of S-Caps is simpler than that of Caps. It is easy to assemble S-Caps.

2.2 Materials of tubes

⚠ CAUTION

Run the rotor at the proper temperature (see the below). Otherwise the tubes may be damaged or deformed during operation. When running the rotor beyond this limit, test the tube to ensure that there is no abnormality before actual operation.

⚠ CAUTION

Check the “Chemical resistance chart” attached to the rotor, and do not use any sample inapplicable to the tubes and bottles. Using such a sample could corrode or deteriorate them.

⚠ CAUTION

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.

The materials of tubes are as follows. Refer to the "Chemical resistance chart" (P/N S999313) attached to the rotor.

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

PET ; Polyethylene terephthalate
Transparent. Can not be autoclaved. Sliceable and puncturable. Weak in organic solution. Use the tubes/bottles at a temperature between 4 ℃ and 20 ℃.

PE ; Polyethylene
Opaque. Can not be autoclaved. Excellent in chemical resistance. Use the tubes/bottles at a temperature between 4 ℃ and 20 ℃.

PP ; Polypropylene
Strong but susceptible to low temperature (brittle point:0℃). It can be autoclaved at 121℃ or less. Use the tubes/bottles at a temperature between 4 ℃ and 25 ℃.

PA ; Polypropylene copolymer
Strong and can be autoclaved at 115℃ or less. Use the tubes/bottles at a temperature between 4 ℃ and 25 ℃.

SST ; Stainless steel
Excellent in chemical resistance and heat resistance. It can be autoclaved at 121℃ or less.

TI ; Titanium alloy
Excellent in chemical resistance and heat resistance, and lighter than stainless steel. It can be autoclaved at 121℃ or less.

2.3 Washing

1) Wash with tap water or dilute neutral detergent after use. If these are heavy stains, soak it in dilute neutral detergent for a while, and wash with a soft brush carefully.
2) Rinse it with tap water and distilled water.
3) Dry it in the air.

- PC tubes are weak in chemical resistance to alkali solution. Use neutral detergent (between pH5 and pH9). Do not allow the soaking in dilute detergent for a long time because otherwise the tubes would become brittle.
- For space caps, float spacers, spacers, crowns and plugs, wash in the same way with tubes. After washing dry completely and store as a unit.
- Take care of pH of detergent when performing ultrasonic washing.
- Washing conditions
  Use neutral detergent between pH5 and pH9 and hot water (50°C or less) for cleaning tubes, bottles, caps, and adapters. Ultrasonic washing (pH7) is suitable for cleaning them, too.

> ⚠ **CAUTION**
> In all cases, use neutral detergent (between pH5 and pH9).

- Drying conditions
  Dry tubes, bottles, caps, and adapters in the air.

2.4 Sterilization

Refer to Table 2-1 for sterilization of tubes.

How to autoclave tubes

1) Wash tubes well.
2) Stand it in the heat-resistance rack.
3) After autoclaving, take out tubes after the temperature in the tank of autoclave device lower to room temperature.

Table 2-1 Sterilizing condition S: Satisfactory U: Unsatisfactory

Sterilizing condition		Tubes							Caps, Space caps			Float spacers	Bottle* caps	Adapters
		PA	PP	PET	PE	PC	SST	TI	TI	AL	m-PPE	m-PPE		
Autoclaving	115°C(0.7kg/cm^2) for 30min.	S	S	U	U	S	S	S	S	S	S	S	S	S
	121°C(1.0kg/cm^2) for 20min.	U	S	U	U	S	S	S	S	S	S	S	S	S
	126°C (1.4kg/cm^2) for 15min.	U	U	U	U	U	U	U	U	U	U	U	U	U
Boiling	15-30min.	S	S	U	U	S	S	S	S	S	S	S	S	S
UV rays	200-300mm	U	U	U	U	U	S	S	S	S	U	U	U	U
Gas	Ethylene oxide	S	S	U	S	U	S	S	S	S	U	U	S	S
	Formaldehyde	S	S	S	S	S	S	S	S	S	S	S	S	S
Chemical solution	Ethanol(70%)	S	S	S	S	U	S	S	S	S	S	S	S	S
	Hydrogen Peroxide(3%)	S	S	S	S	S	S	S	S	S	S	S	S	U
	Formalin	S	S	S	S	S	U	S	S	U	S	S	S	S

*The green screw cap (old product) for bottle cannot be autoclaved, but the blue and black screw caps can.

2.5 Storage

Store the tubes room temperature. DO NOT store at high temperature or humidity or in a chemical vapor or expose to UV radiation.

2.6 Inspection

Inspect tubes and caps after use, and replace them if you find any damage, deterioration or wear.

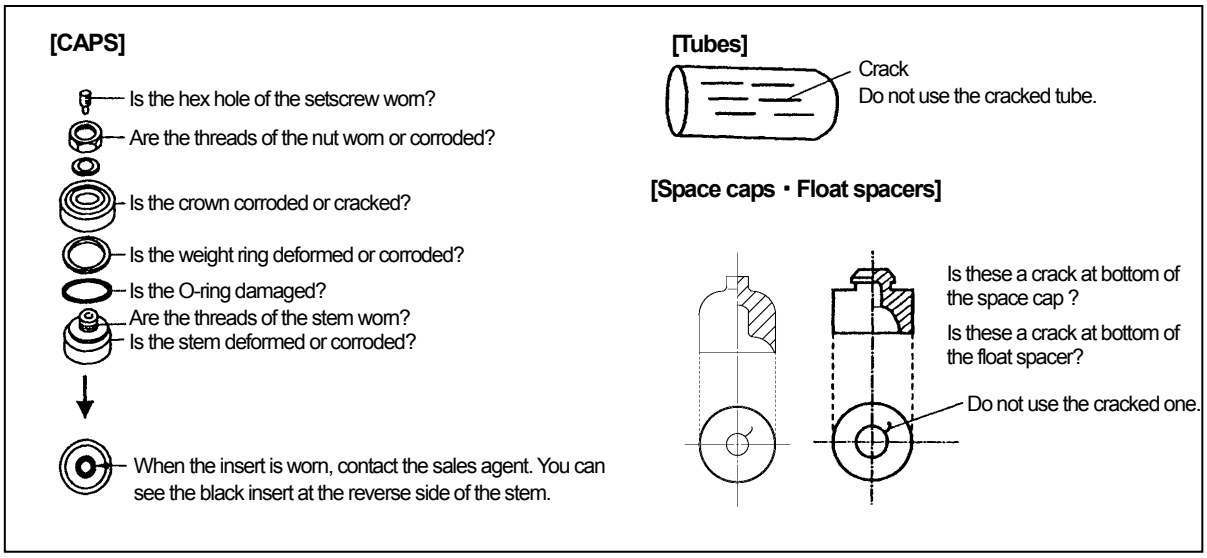


Fig. 2-4 Inspection tubes and caps

2.7 Life

The life of tubes/bottles depends upon the sample, rotor speed, temperature, etc. For standard life of tubes/bottles, refer to table 2-2.

PET tubes, seal tubes, and micro tubes are disposable.

Table 2-2 Standard life of tubes/bottles

Tubes/Bottles \ Conditions		Ordinary condition*1	Rotor speed is 120,000rpm or more.	Sterilizing condition: Autoclaving	Sample: Weak Alkali*2
Thin walled tubes	PA, PP	5 times	—	1 time	5 times
	PC	5 times	1 time	1 time	1 time
	PE	5 times	—	—	5 times
Thick walled tubes/bottles	PA, PP	5 times	1 time	1 time	5 times
	PC	20 times	1 time	5 times	10 times
	PE	20 times	—	—	20 times

*1: Ordinary condition: Aqueous samples (between pH5 and pH9) are used for 24 hours.

*2: Sample of weak Alkali: Sample (between pH7 and pH9)

- Tubes capped with S series caps are disposable.
- When using 0.9PC thick-walled tubes (Part No. S304296A) with 2S5 adapters (Part No. 336697A), 0.9PC thick-walled tubes are disposable.
  When using 2S5 adapters with 0.9PC thick-walled tubes, run the rotor at 10°C or less.
- When the rotor speed is 25,000 rpm or more, a lot of fine stripes may occur on the tube, but there is no problem such as leakage of liquid, etc.

The life expectancy of a plastic tube/bottle as the above is an approximate guide. We do not warrant the life expectancies of tubes/bottles.

2.8 Preparation of seal tubes

1) Inject samples of the same density into the seal tubes with an injector until little air remains. Do not leave a large air. Too much air can cause the tube to deform and the sample to leak.

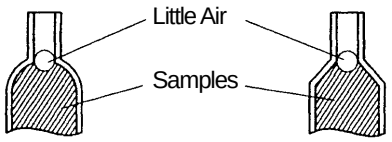


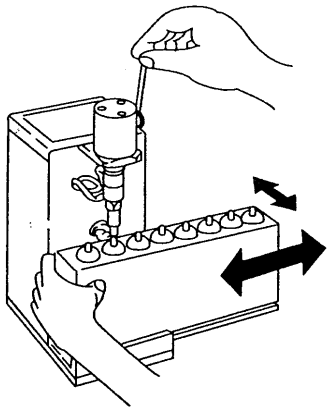
Fig. 2-5 Filling samples into seal tubes

2) Fill the opposing tubes on rotor to the same level, and balance within 0.2g. If using the CS150NX and CS-FNX/CS-GXⅡ /CS-GXL/CS-GX series centrifuges, balance only by lining up and viewing the liquid level of two tubes.

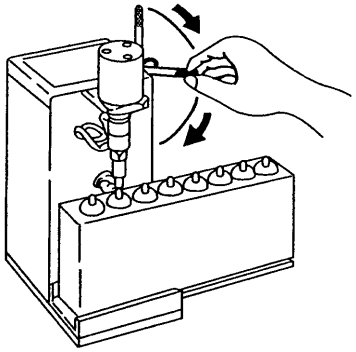
3) Wipe off liquid from the neck of the seal tube.

4) Weld the seal tube according to the instruction manual of the STF-1, STF2, and STF3 tube sealer.

(i) Move the tube rack to the direction of arrows shown in Fig. 3-5 to adjust position of the neck of the tubes (under the heater).


Fig. 2-6 Adjusting tube rack

(ii) Depress the handle until the heater presses the neck of the tube and then keep this condition for 1 to 3 seconds. Then depress the handle to the end and wait until the HEAT lamp is put out.


Fig. 2-7 Welding seal tubes

5) Remove the protrusion on the welding part with your nail. Push the seal tube slightly and check that the sample does not leak. If the tubes are not welded completely, the tube may be deformed and the samples will leak.

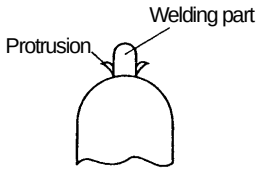


Fig. 2-8 Protrusion of seal tube

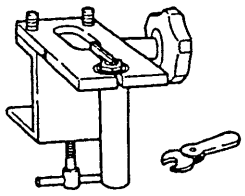
2.9 Preparation of Caps

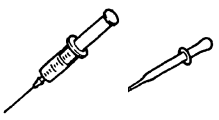
Preparation


<Tube>


<Cap>


<Tube Setter (B)>

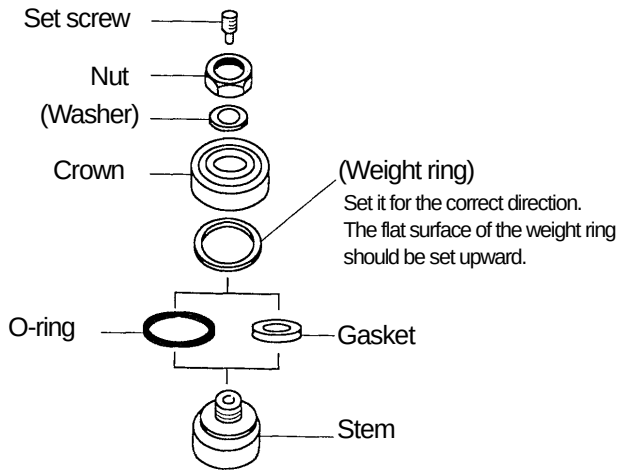

< Tightening tools of the caps >
See Table 2-4.


<Injector>
Example)
Injector whose
diameter is 1.5 mm.


<Sample>

1. Preparing the caps

(1) Confirm the composition of the cap (see Table 2-3)
For about how to inspect the cap, refer to section 2.6.



(2) Fix the tube vice to a desk, etc. by according turning the handle (B).

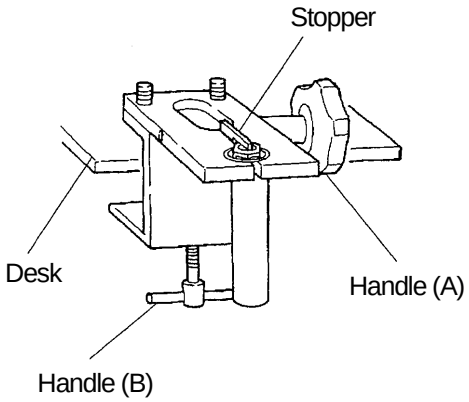


Table 2-3 Composition of the cap

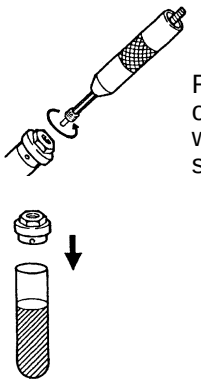
	Set screw	Nut	Washer	Crown	Weight ring	O-ring	Gasket	Stem	Insert
A3-AL Cap 336711A	---	80130058 AL	---	474123 AL	---	S401807A NBR	---	474121 AL	---
B-AL Cap 414429A	S401829A SST	441393 AL	---	414432 AL	---	---	S401778A CR	453411A AL	S401791A NY
C-TI Cap 463577A	S401829A SST	463567 TI	---	463569 TI	---	S401803A NBR	---	463576A TI	S401791A NY
E3-AL Cap S305231A	S401829A SST	S408401 AL	S401813A POM	S408400 AL	459814 AL	S401787A NBR	---	S408421A AL	S401791A NY

●Materials.
SST: Stainless steel
AL: Aluminum alloy
TI: Titanium alloy
POM: Polyacetal
NBR: Nitrile-butadiene rubber
CR: Neoprene rubber
NY: Nylon

NOTE1) the upper = part No.
the lower = materials
NOTE2) Set screw, washers, O-rings, gaskets and inserts are available in sets of 10.
NOTE3) Individual nuts, crowns, weights and stems are available. The stem is provided with an insert.

2. Assembling the cap

(1) Assemble the cap loosely.
Unscrew the setscrew.
(2) Fill the tube up to three fourths with the sample, depress the cap until the tube comes in contact with the crown.
(3) Tighten the nut manually.

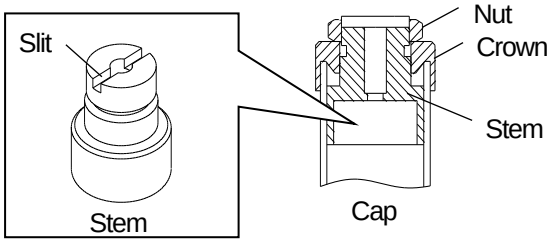


Remove the set screw of the cap using hex wrench side of the tube setter.

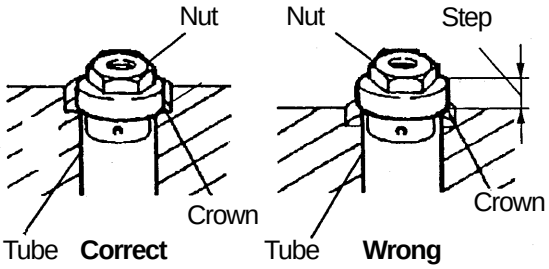
3. Tighten the cap

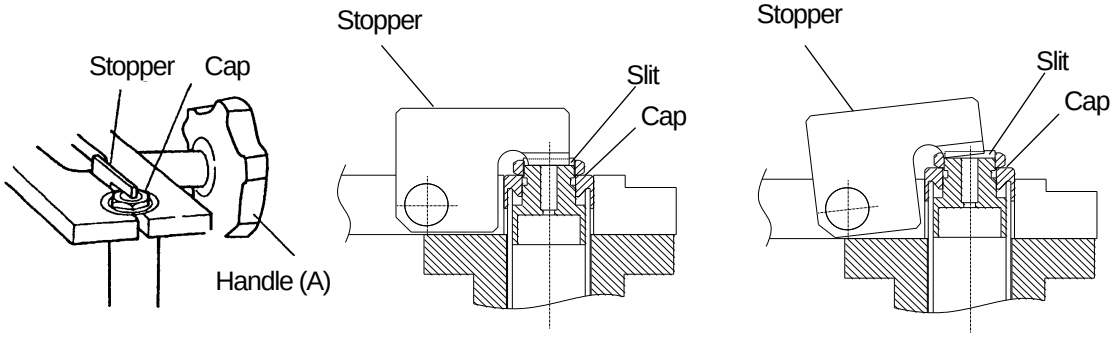
(1) Insert the tube and the cap into the hole of the tube vice.
If there is a step between the top surface of the crown and that of tube vice, depress the cap until there is no step between them.

Construction of Cap and Stem



(2) Tighten the handle (A) of the tube vice to fix the tube and cap. When you use the tube vice with the stopper, turn the cap to introduce the stopper into the slit of the stem on the cap.
If you tight the nut at wrong position, the stopper may be damaged. Examples of correct position and wrong position on setting the stopper are shown in the below figures.

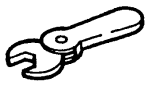




Correct position **Wrong position**

(3) Tighten the nut with a torque wrench or a box wrench.
If using the tube vice with the stopper, tighten the nut with a torque wrench with a clutch as holding down the stopper by your finger.

●Torque wrench with a clutch



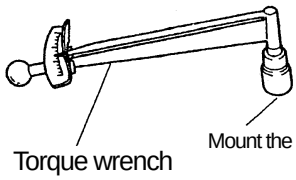
Tighten to function the clutch of the torque wrench.

●Box wrench



Tighten the nut securely.

●Torque wrench with a clutch



Torque wrench

Mount the socket that is applicable to the nut.

Tighten to a specified tightening torque (see Table 2-4).

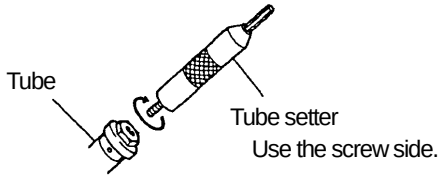
Tightening tools are specified for different caps (see Table 2-4).

Table 2-4 Tightening tools of the cap and Specified tightening torque

Caps • Name • Part No.	Tool sets	Parts of the tool set		Tightening torque (N • m)	Applicable tubes	Applicable rotors
		Tube vices	Box wrenches Torque wrenches			
A3-AL Cap 336711A	----	S303696A Tube vice A2	S406641 Box wrench	–	4PA Tube 3PA Tube	S58A
B-AL Cap 414429A	S300715A Tool set (B)	348253A Tube vice (B)	4361453 Box wrench	–	6.5PA Tube 6.5PC Tube 5PA Tube	S58A
C-TI Cap 463577A(10)	341109A Tool set (C2)	333885A Tube vice (C2)	469283 Torque wrench	10	12PA Tube 12PE Tube 12PC Tube 12SST Tube	S58A
E3-AL Cap S305231A (6)	----	S309247A Tube vice (D)	477456A Torque wrench	6	30PA Tube	S50A

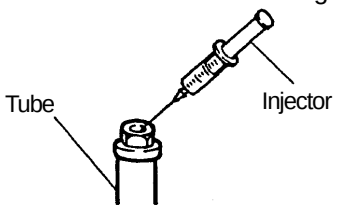
*1 N • m=10.2kgf • m

(4) Loose the handle (A) of the tube vice. and remove the tube with the tube setter.

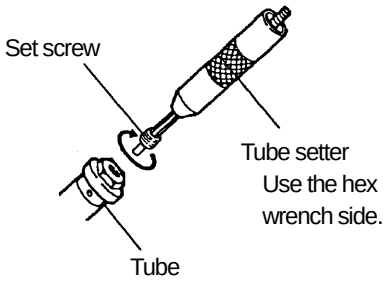


4. Balancing

(1) Fill up the tube with the sample by using the injector etc.
Otherwise the tube may be deformed during operation.
Approximately equal quantities of sample in tubes are sufficient for balancing.



(2) Tighten the setscrew securely with the tube setter.



Tighten the setscrew to prevent the leakage of the sample.

2.10 Preparation of S-Caps

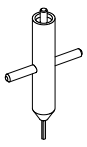
⚠ CAUTION

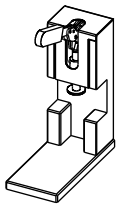
- If there is any abnormality such as corrosion, stop use of S-Caps and contact an authorized sales or service representative.
- NY Insert (Part No. :S401791A) are consumable parts. It is necessary to replace it with the new one if it is worn. Contact an authorized sales or service representative when replacing it.

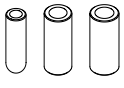
Preparation

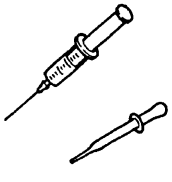

<Tube>


<Cap>


<Tube Setter>


<Hand Press>

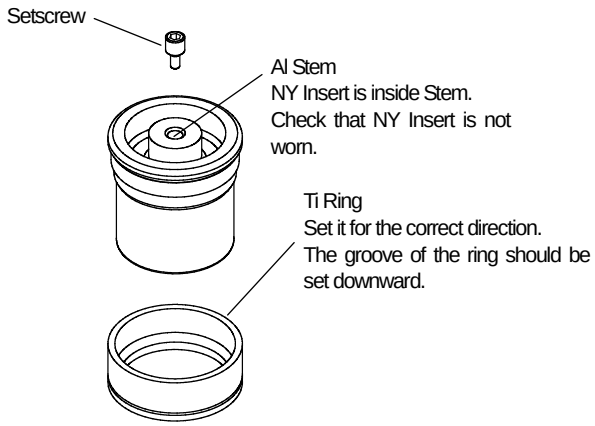

<Tube Holder>


<Injector>
Example)
Injector whose diameter is 1.5 mm.

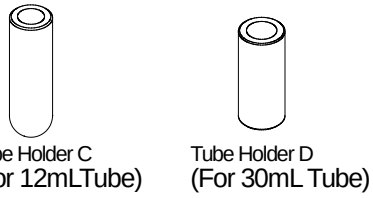

<Sample>

1. Preparing the caps and adapters

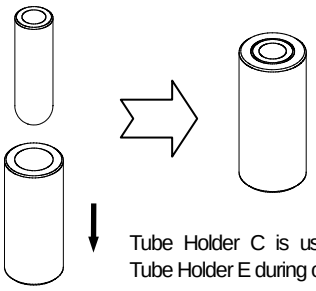
① Confirm the composition of the cap.
For about how to inspect the cap, refer to section 2.6.



② Select the S-Cap, Tool Set , and Tube Holder according to the kinds of tubes.

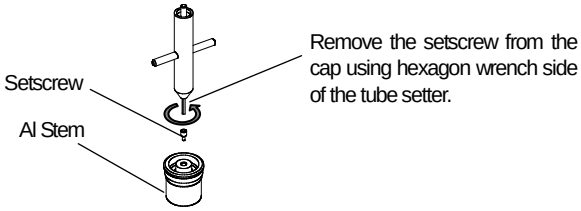


Use the Tube Holder C inserted in Tube Holder E.

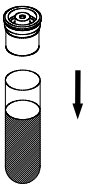


2. Depressing the Al Stem

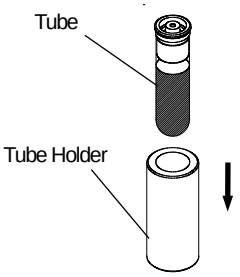
① Remove the setscrew from the Al Stem.



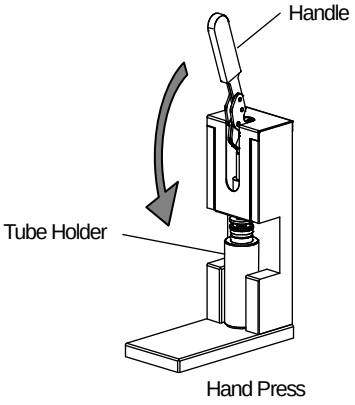
② Fill the tube up to three fourths with the sample.
Place the Al Stem on the mouth of the tube.



③Set the tube in the Tube Holder.

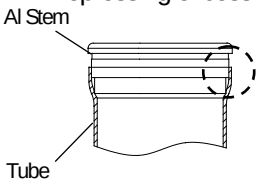


④Place the Tube Holder on the suitable position of the Hand Press. Then push down the Handle to depress the Al Stem to the desirable position.



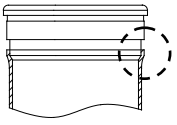
✕ Depressing improperly

Depressing excessively



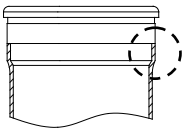
The step of the Stem is inside the tube.

Depressing insufficiently



There is a gap between the step of the Stem and the mouth of the tube.

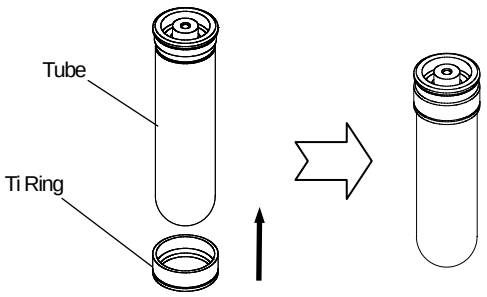
○ Depressing properly

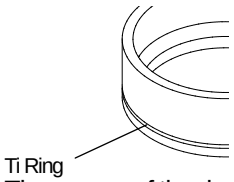


Depress the Al Stem until the step of the Stem fit on the mouth of the tube.

3. Depressing the Ti Ring

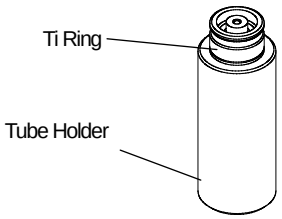
① Remove the tube with the Al Stem from the Tube Holder.
Then mount the Ti Ring on the tube from the bottom of the tube with the groove of the ring facing downward.



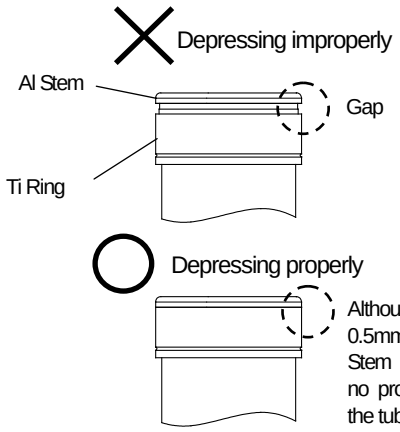


The groove of the ring should be set downward.

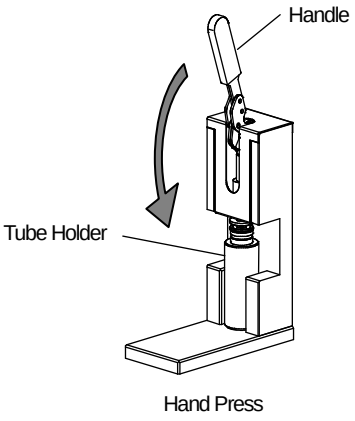
② Set the tube as the above ① to the Tube Holder.



③ Place the Tube Holder on the suitable position of the Hand Press. Then push down the Handle until the Ti Ring contacts the step of the Al Stem.



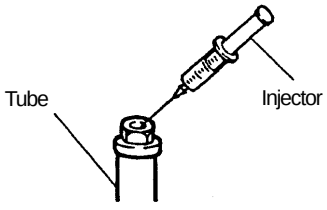
Although there may be about 0.5mm gap between the Al Stem and the Ti Ring, there is no problem in performance for the tube seal.



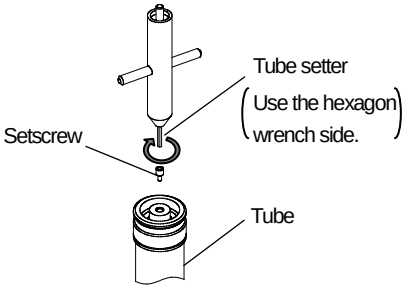
Hand Press

4. Balancing

①Fill up the tube with the sample by using the injector etc.
Otherwise the tube may be deformed during operation.
Approximately equal quantities of sample in tubes are sufficient for balancing.



②Tighten the setscrew securely with the tube setter.



Tighten the setscrew to prevent the leakage of the sample.

3. How to use rotor

⚠ CAUTION

Cool the rotor and sample before centrifugation when running the rotor less than an hour. Otherwise the rotor and the sample may not be cooled to the desired temperature.

⚠ CAUTION

Run the rotor at the proper temperature (see Table 3-1). Otherwise the tubes may be damaged or deformed during operation. When running the rotor beyond this limit, test the tube to ensure that there is no abnormality before actual operation.

Table 3.1 Set temperature for Tubes/Bottles

Tubes/Bottles	Set temperature
PE, PET	Between 4℃ and 20℃
PA, PP, PC	Between 4℃ and 25℃

3.1 Allowable rotor speeds

⚠ WARNING

The rotor should never be used at any speed higher than the maximum speed mentioned on the rotor. Depending upon the density of samples and the tubes in use, however, the rotor may not be used at its maximum speed. It must be lowered to following allowable speed under some conditions. DO NOT exceed this allowable speed.

You can run the rotor at its maximum speed when using a sample whose average density is less than 1.7g/mL (when you run the S50A and S58A rotor, you can run the S50A and S58A rotor at its maximum speed when using a sample whose average density is less than 1.2g/mL). However, the allowable speed may be lower depending on the density of sample or the use of salt such as cesium chloride or the combination of the tubes and caps (see the below.). Do not exceed the allowable speed of the rotor.

(1) Allowable speed for density of sample

1) Rotors other than the S50A and S58A

⚠ WARNING

Never run the rotor at its maximum speed when using a sample with an average density more than 1.7g/mL .

To centrifuge a sample with an average density more than 1.7g/mL, reduce to the allowable speed by the following equation.

$$\text{Allowable speed (rpm)} = \text{Maximum speed of the rotor (rpm)} \times \sqrt{\frac{1.7}{\text{Average density of sample (g/mL)}}}$$

2) S50A and S58A rotor only

⚠ WARNING

The allowable average density of sample for the S50A and S58A rotor is 1.2 g/mL: Do not run the rotor with samples whose average density is over 1.2 g/mL at maximum speed.

To centrifuge a sample with an average density more than 1.2g/mL, reduce to the allowable speed by the following equation.

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

(2) Allowable speed for density gradient medium

⚠ WARNING

Do not exceed the allowable speed * when using the cesium chloride (CsCl) solution.
*Compare (A) and (B). The allowable speed is the lower one of them.

(A) the allowable speed depending on density of sample (see section 2.1)

(B) the allowable speed depending on density of the cesium chloride (CsCl) solution (see Appendix 4)

The cesium chloride (CsCl) solution is frequently used as a density gradient medium. If the CsCl solution with a high density may be precipitated under some centrifuge condition, however. The crystallized CsCl which have a high density (approx. 4g/mL) stress the rotor excessively and can cause rotor failure. Also, the precipitation will greatly affect the density gradient of the CsCl solution and separation status of the sample. Therefore, lower the speed to avoid precipitation in the solution. Refer to "Appendix 4 Relationship between density of cesium chloride solution and speed" for the allowable speed when using the CsCl solution. The cesium trifluoroacetate (CsTFA) solution which has a high density might stress the rotor excessively. Even if you use any solution applicable to the tubes and the adapters (see the chemical resistance chart (Part No. S999313)), the tubes and the adapters might be deteriorated (deterioration: discolored surface, scratches, cracks, deformation, etc.) by a solution with a high density. It is recommended that you test the tubes before actual operation to ensure that the tubes are not deteriorated for the solution whose average density is over 1.2 g/mL, especially when you use the tubes on the market (micro tubes etc.).

(3) Allowable speed for combination of tubes, caps, etc.

The speed of the rotor should be limited by the combination of tubes, caps, etc. For detail, consult "Appendix 2 Rotor specifications".

3.2 Sample limitation

⚠ WARNING

Never use explosive or flammable samples. This centrifuge and rotor are not explosion-proofs.
When using radioactive, toxic, or pathogenic samples, take additional precautions to prevent exposure to these samples, e.g., use of isolation areas. The ultracentrifuges and the rotors don't prevent a dispersion of the sample at an accident.

3.3 Adhesion of sample etc.

⚠ CAUTION

If sample etc., adhere to the rotor, use a soft cloth etc. to wipe it off; leaving it could corrode the rotor.

3.4 Angle rotors (except S55A2)

⚠ CAUTION

Be careful that the cover and drive hole (crown hole) of the quick-setting type rotor have a sharp drive pin.

(1) Preparation of tubes

● **In case of using thick-walled tubes**

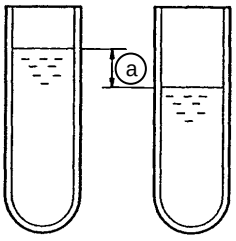
1) Inject samples of the same density into thick-walled tubes with an injector. The net capacity of each tube is shown in "Appendix 2. Rotor Specifications". Exceeding the net capacity causes leakage for centrifuge.
2) Balance the tubes that are symmetrically arranged. The approximate allowable imbalance is shown in Table 3-2.

⚠ CAUTION

Extremely different sample quantities must be avoided. Failure to do so might damage mechanical components. Although you balanced the tubes within the approximate allowable imbalance (see Table 3.2), alarm message “IMBALANCE” might appear. Balance tubes more accurately again if alarm message “IMBALANCE” appears.

Table 3-2 Approximate allowable imbalance

Rotor	Approximate allowable imbalance level (a) of sample for CS150NX/ CS150FNX/CS120FNX/ CS150GXⅡ/CS120GXⅡ/ CS150GXL/CS120GXL/ CS150GX/CS120GX	Approximate allowable imbalance for CS120FX/CS100FX/ CS120EX/CS100EX/ CS120/CS100/ CP120H/CP100H
S150AT	5mm	———
S140AT	3mm	———
S120AT2	5mm	0.2g
S120AT3	5mm	0.1g
S110AT	4mm	———
S100AT3	5mm	0.05g
S100AT4	5mm	0.2g
S80AT2	5mm	0.1g
S80AT3	4mm	———
S70AT	5mm	0.1g
S58A	5mm	———
S50A	3mm	———



Imbalance in level of sample

● **In case of using SST tubes or TI tubes.**

1) SST tubes or TI tubes may vary on their weight. Use two tubes whose weight is within that shown in Table 3-3. Tube weight is stamped on the side of the tube.
2) Inject samples of the same density into tubes with an injector. The net capacity of each tube is shown in "Appendix 2. Rotor Specifications". Exceeding the net capacity causes leakage for centrifuge.
3) Balance the tubes that are symmetrically arranged. The approximate allowable imbalance is shown in Table 3-3.

Table 3-3
Approximate allowable imbalance

Rotor	Tubes without samples	Tubes with samples
S110AT	0.2g	0.5g
S58A	0.3g	0.7g

● **In case of using seal tubes**

Prepare seal tubes according to "2.8 Preparation of seal tubes".

(2) Preparation of rotor

1) Check the following sections of the rotor.
   - Is foreign matter adhering to the tube cavity or the drive hole?
   - Is the drive pin of the cover deformed?
     Are the drive pins of the drive holes (crown holes) of the S140AT, S58A, and S50A rotor deformed?
   - Are the threads of the rotor body and the cover worn?
2) For runs at other than room temperature, refrigerate or warm the rotor to the operating temperature beforehand, When the temperature of rotor is lower over 10°C than the operating temperature, detaching the cover of the rotor might become difficult.
3) Set rotor to the rotor vise.
4) Coat the packing lightly with silicone grease (vacuum grease) to make completely air-tight, and wipe them clean of excess grease. When using the S58A and S50A rotor, coat the handle packing (O-ring) lightly with silicone grease (vacuum grease) after removing the handle from the rotor cover. Turn the handle to the counterclockwise pulling it up to remove the handle from the rotor cover (see Fig. 3-1). After having finished coating a vacuum grease to the handle packing (O-ring), set the handle with the handle packing (O-ring) on the rotor body, and then turn handle to the clockwise to assemble the handle into the rotor cover.

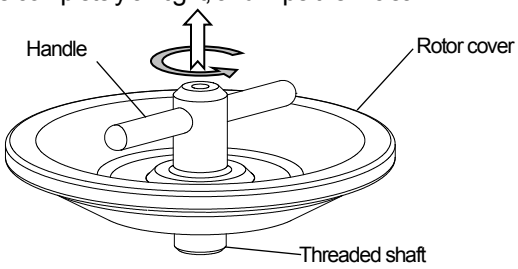


Fig. 3-1 How to remove the handle

5) Apply a thin coat of lubricant for screw on threads of the rotor and the cover.

(3) Setting tubes

1) Wipe off moisture around each tube, then, load the rotor. Place the tubes which are balanced, in the rotor symmetrically. Serious imbalance can cause damage to the drive spindle of the ultracentrifuge and the drive hole in the rotor.

⚠ CAUTION

Be sure to load the balanced tubes/bottles symmetrically with respect to drive shaft.

2) In case of seal tubes, place the space caps on the tubes to prevent deformation of the tubes during centrifuge.
   For some sealed tube and rotor combinations, a float spacer must be set before setting the space cap.
3) Place the cover on the rotor and tighten the cover until the packing (O-ring) is fully compressed.
   When using the S58A and S50A rotor, tighten the handle until the packing (O-ring) is fully compressed.

⚠ CAUTION

Fasten the cover or the handle securely. Otherwise the rotor cover might come off during the operation and it might damage the centrifuge and the rotor.

(4) Operation

1) Gently and securely set the rotor onto the drive spindle in the ultracentrifuge. If using the centrifuge except the CS150NX and CS-FNX/CS-GXⅡ/CS-GXL/CS-GX series, fasten the rotor to the drive spindle in according with "3.8 Fixing the screw-setting rotors to the centrifuge and detaching".

⚠ CAUTION

The rotors is classified the two types, quick-setting type and screw setting type, by the difference of the method of the installation on the centrifuge. The available centrifuge for them is different respectively. Confirm which type of the rotor can be used on your centrifuge. In case of the screw-setting type rotor, fasten it to the centrifuge securely.

2) For operation, refer to the instruction manual of the micro ultracentrifuge.

(5) Removing sample

1) Upon completion of centrifuge, carefully remove the rotor from the drive spindle. If using the centrifuge except the CS150NX and CS-FNX/CS-GXⅡ/CS-GXL/CS-GX series, detach the rotor from the drive spindle in according with "3.8 Fixing the screw-setting rotors to the centrifuge and detaching".
2) Remove the cover. If the cover is too tight to be removed, use the cover opener (rubber sheet) or the cover opener 3 provided to prevent slippage for easy removal (For information about the cover opener 3, refer to "3.9 How to Use Cover Opener 3"). It can be removed more easily by using the cover opener 2, which is an optional part as shown in Appendix 3.
3) Remove space caps etc. and tubes with tweezers or the tube setter.
4) Recover supernatants or pellets. In case of the seal tubes, the sample recovery stand, which is an optional part as shown in Appendix 3, is convenient when using recovering.
5) Perform maintenance and inspection after use.

⚠ CAUTION

Perform maintenance and inspection of the rotor each time after using it. If you find abnormality in the rotor, stop using it and contact an authorized sales or service representative.

3.5 S55A2 rotor

⚠ CAUTION

- Do not use other micro tubes (see Appendix 2) because they may be cracked, damaged or the liquid may leak.
- Be careful that the cover and drive hole (crown hole) of the quick-setting type rotor have sharp drive pins.

(1) Preparation of sample

1) Fill the tubes with sample of the same density, using an injector, etc. The maximum fill volume is 1.3mL. More volumes cause liquid leak.
2) Balance the tubes that are symmetrically arranged. In case of the CS150NX and CS-FNX/CS-GXⅡ/CS-GXL/CS-GX series centrifuges, balance the approximate difference of sample level within 5mm.
3) Firmly close the lids of tubes after filling.

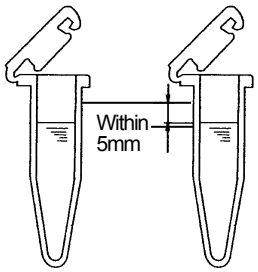


Fig. 3-2 Difference in level with approximate allowable imbalance using the CS150NX and CS-FNX/CS-GXⅡ/ CS-GXL /CS-GX series centrifuges

⚠ CAUTION

Extremely different sample quantities must be avoided. Failure to do so might damage mechanical components. Although you balanced the tubes within the approximate allowable imbalance (see the above), alarm message “IMBALANCE” might appear. Balance tubes more accurately again if alarm message “IMBALANCE” appears.

(2) Preparation of rotor

1) Check the following sections of the rotor.
- Is foreign matter adhering to the tube cavity or the drive hole?
- Is the drive pin of the drive hole (crown hole) of the S55A2 rotor deformed?
- Are the threads of the rotor body and the handle worn?

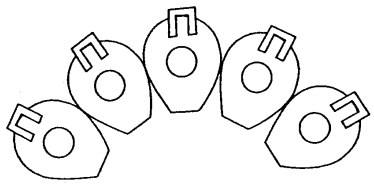
2) For runs at other than room temperature, refrigerate or warm the rotor to the operating temperature before-hand. When the temperature of rotor is lower over 10°C than the operating temperature, detaching the cover of the rotor might become difficult.
3) Set rotor to the rotor vise.
4) Coat the packing lightly with silicone grease (vacuum grease) to make completely air-tight, and wipe them clean of excess grease. Coat the handle packing (O-ring) lightly with silicone grease (vacuum grease) after removing the handle from the rotor cover. Turn the handle to the counterclockwise pulling it up to remove the handle from the rotor cover (see Fig. 3-1). After having finished coating a vacuum grease to the handle packing (O-ring), set the handle with the handle packing (O-ring) on the rotor body, and then turn handle to the clockwise to assemble the handle into the rotor cover.
5) Apply a thin coat of lubricant for screw on threads of the rotor and the handle.

(3) Setting tubes

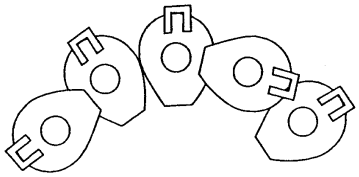
1) Wipe off moisture around each tube, then, load the rotor. Place the tubes which are balanced, in the rotor symmetrically. Serious imbalance can cause damage to the drive spindle of the ultracentrifuge and the drive hole in the rotor.

⚠ CAUTION

Do not overlap the tops of adjoining tube (see the below).



(1) CORRECT



(2) WRONG

⚠ CAUTION

Be sure to load the balanced tubes symmetrically with respect to drive shaft.

2) Place the cover and handle on the rotor and tighten the handle until the packing (O-ring) is fully compressed.

⚠ CAUTION

Fasten the handle securely. Otherwise the rotor cover might come off during the operation and it might damage the centrifuge and the rotor.

(4) Operation

1) Gently and securely set the rotor onto the drive spindle in the ultracentrifuge.

⚠ CAUTION

The rotors is classified the two types, quick-setting type and screw setting type, by the difference of the method of the installation on the centrifuge. The available centrifuge for them is different respectively. Confirm which type of the rotor can be used on your centrifuge. In case of the screw-setting type rotor, fasten it to the centrifuge securely.

2) For operation, refer to the instruction manual of the micro ultracentrifuge.

(5) Removing sample

1) Upon completion of centrifugation, carefully remove the rotor from the drive spindle.
2) Remove the cover.
3) Remove tubes with tweezers.
4) Recover supernatants or pellets.
5) Perform maintenance and inspection after use.

⚠ CAUTION

Perform maintenance and inspection of the rotor each time after using it. If you find abnormality in the rotor, stop using it and contact an authorized sales or service representative.

3.6 Swing rotor

(1) Preparation of tubes

- **In case of using thick-walled tubes**

1) Fill the tubes with sample of the same density up to a level within 3mm from the top of the tube.
   When the tubes are used under 100,000 × g, you could use them with a sample level within 10mm from the top. If the volume of the sample is small, it will be occur buckling of the tubes.
2) Balance the tubes (that are symmetrically arranged) within 0.2g. If using the CS150NX and CS-FNX/CS-GXⅡ/CS-GXL/CS-GX series centrifuges, balance tubes according to Fig. 3-3 and Fig. 3-4.

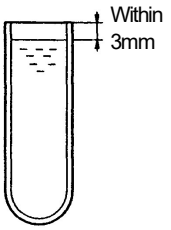


Fig. 3-3 Filling tube for swing rotor
(RCF: 100,000 xg and over)

⚠ CAUTION

Extremely different sample quantities must be avoided. Failure to do so might damage mechanical components. Although you balanced the tubes within the approximate allowable imbalance (see the above), alarm message "IMBALANCE" might appear. Balance tubes more accurately again if alarm message "IMBALANCE" appears.

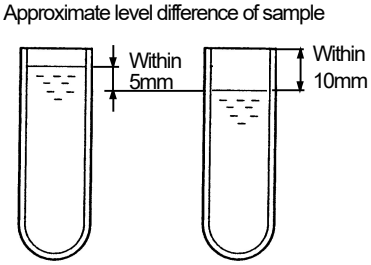


Fig. 3-4 Filling tube for swing rotor
(RCF: 100,000 xg and less)

3) Put the tubes in the bucket stand.

- **In case of using seal tubes**

Prepare seal tubes according to "2.8 Preparation of seal tubes".

(2) Preparation of buckets

1) Check the following sections of the rotor and buckets.
   - Is foreign matter adhering to the tube cavity of the buckets or the drive hole of the rotor?
   - Are the drive pin or the hook of the buckets deformed?
   - Are the threads of the buckets or its caps worn?
2) Wipe well the tube cavity of the buckets.
3) Set O-ring coated with silicone grease (vacuum grease) thinly into the bucket. Worn or damaged O-ring might cause poor vacuum sealing. Replace the O-ring with spare one.
4) Apply a thin coat of lubricant for screw on threads of the bucket caps.
5) Put the prepared bucket in the bucket stand.

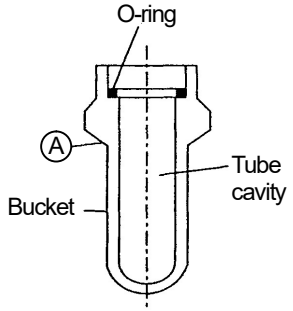


Fig. 3-5 Bucket of swing rotor

(3) Setting tubes

1) Wipe off moisture around each tube, then, load the rotor. Place the tubes which are balanced within 0.2g, in the bucket symmetrically. Serious imbalance can cause damage to the drive spindle of the ultracentrifuge and the drive hole in the rotor.
2) In case of seal tubes, place the space caps on the tubes to prevent deformation of the tubes during centrifuge.

⚠ CAUTION

Be sure to load the balanced tubes symmetrically with respect to drive shaft.

3) Match cap numbers with bucket numbers. Tighten the cap into the bucket with the cap spanner inserted to the base of the cap, and be coincided the fitting mark (small circle) on the bucket with that on the cap.
   In the case of S50ST, the cap spanner is not required.

⚠ CAUTION

Fasten the cap securely. Imperfect tightening of cap may cause imbalance operation and it may cause the serious accident.

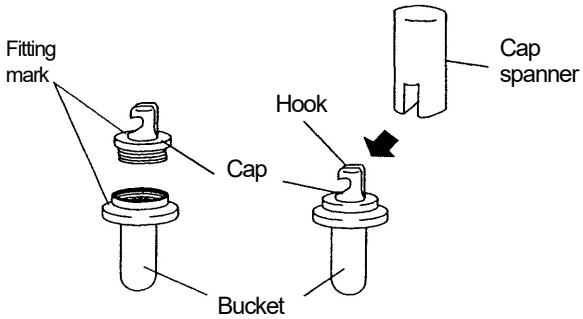


Fig. 3-6 Tightening bucket cap with cap spanner

(4) Installing buckets

● Rotors other than the S50ST

Install all of the numbered buckets in the corresponding position of the rotor. Make sure that both hooks properly hang on the pin.

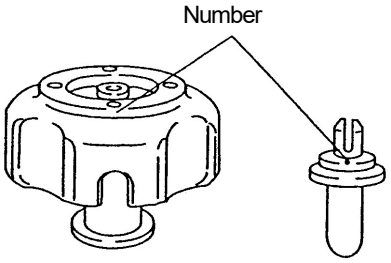


Fig. 3-7 Numbered bucket and rotor

● S50ST rotor

Install all of the numbered buckets from the upside of the rotor in the corresponding position of the rotor. At that time, support the bottom of the bucket. Make sure that both pins properly hang on the rotor groove.

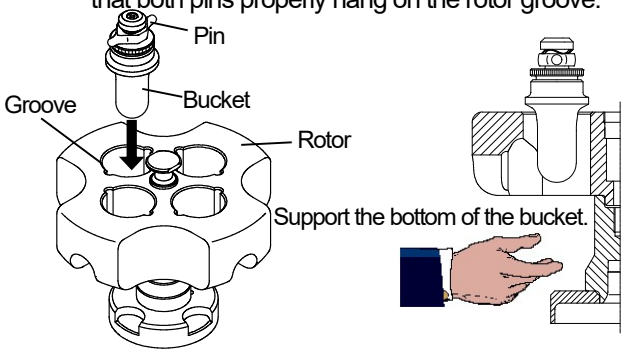


Fig. 3-8 Removing /installing buckets

⚠ WARNING

Be sure to set all buckets of the same type whether or not samples are put in buckets: Failure to do so could not only cause the rotor to vibrate but can result in the rotor being deformed and the buckets becoming detached, which is very dangerous. Never use buckets made by other companies, or any other type of bucket that is not exclusively made for the rotor even if they are made by us.
All the buckets must be correctly capped.

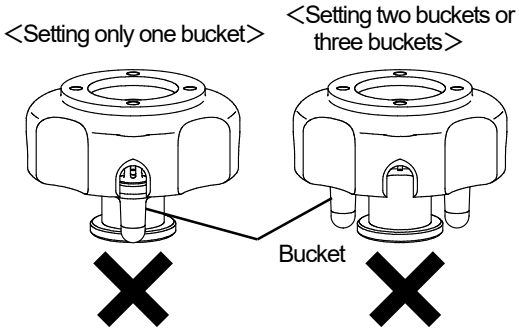


Fig. 3-9 Examples of incorrect bucket setting

(5) Operation

1) Gently and securely set the rotor onto the drive spindle in the ultracentrifuge. If using the centrifuge except the CS150NX and CS-FNX/CS-GXⅡ/CS-GXL/CS-GX series, fasten the rotor to the drive spindle in according with "3.8 Fixing the screw-setting rotors to the centrifuge and detaching".

⚠ CAUTION

1. The rotors is classified the two types, quick-setting type and screw setting type, by the difference of the method of the installation on the centrifuge. The available centrifuge for them is different respectively. Confirm which type of the rotor can be used on your centrifuge. In case of the screw-setting type rotor, fasten it to the centrifuge securely.
2. The S50ST and S52ST rotor can be used with the CS150NX, CS-FNX series, CS-GXⅡ series, and CS-GXL series, but it cannot be used with other centrifuges.

3) For operation, refer to the instruction manual of the micro ultracentrifuge.

(6) Removing sample

1) Upon completion of centrifuge, carefully remove the rotor from the drive spindle. If using the centrifuge except the CS150NX and CS-FNX/CS-GXⅡ/CS-GXL/CS-GX series, detach the rotor to the drive spindle in according with "3.8 Fixing the screw-setting rotors to the centrifuge and detaching".
2) Remove the buckets and stand them in the bucket stand.
3) Loosen the cap of the bucket. See Fig. 3-8 about removing buckets from the S50ST rotor,
4) Take space caps etc. and tubes out with the tweezers or the tube setter.
5) Recover supernatants or pellets. In case of the seal tubes, the sample recovery stand, which is an optional part as shown in Appendix 3, is convenient when using recovering.
6) Perform maintenance and inspection after use.

⚠ CAUTION

Perform maintenance and inspection of the rotor each time after using it. If you find abnormality in the rotor, stop using it and contact an authorized sales or service representative.

3.7 Neo-angle rotors and Vertical rotor

(1) Preparation of tubes

● In case of using seal tubes

Prepare seal tubes according to "2.8 Preparation of seal tubes".

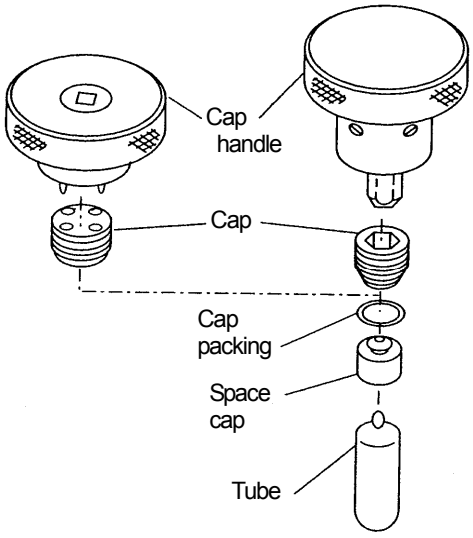
(2) Preparation of rotor

1) Check the following sections of the rotor.
- Is foreign matter adhering to the tube cavity or the drive hole?
- Is the drive pin deformed?
- Are the threads of the rotor body or the caps worn?

2) Set rotor to the rotor vise.
3) Coat the cap packing lightly with silicone grease (vacuum grease) to make completely air-tight, and wipe them clean of excess grease.
4) Apply a thin coat of lubricant for screw on threads of the rotor and the cap.

(3) Setting tubes

1) Wipe off moisture around each tube, then, load the rotor. Place the tubes which are balanced, in the rotor symmetrically. Serious imbalance can cause damage to the drive spindle of the ultracentrifuge and the drive hole in the rotor.
2) In case of seal tubes, place the space caps on the tubes to prevent deformation of the tubes during centrifuge.
3) Place the caps on the tube cavities and tighten it securely with the handle.



[Seal tubes]

Fig. 3-10 Placing and tightening caps

⚠ CAUTION

- Fasten the cap securely.
- If the number of sample tubes to be set is small, do not install space cap or any cap in tube holes into which no tube is inserted, but keep the holes uninstalled for operation.

(4) Operation

1) Gently and securely set the rotor onto the drive spindle in the ultracentrifuge. If using the centrifuge except the CS150NX and CS-FNX/CS-GXⅡ/CS-GXL/CS-GX series, fasten the rotor to the drive spindle in according with "3.8 Fixing the screw-setting rotors to the centrifuge and detaching".

⚠ CAUTION

The rotors is classified the two types, quick-setting type and screw setting type, by the difference of the method of the installation on the centrifuge. The available centrifuge for them is different respectively. Confirm which type of the rotor can be used on your centrifuge. In case of the screw-setting type rotor, fasten it to the centrifuge securely.

3) For operation, refer to the instruction manual of the micro ultracentrifuge.

(5) Removing sample

1) Upon completion of centrifuge, carefully remove the rotor from the drive spindle. If using the centrifuge except the CS150NX and CS-FNX/CS-GXⅡ/CS-GXL/CS-GX series, detach the rotor to the drive spindle in according with "3.8 Fixing the screw-setting rotors to the centrifuge and detaching".
2) Remove the cap with the cap handle.
3) In case of seal tubes, remove space caps and tubes with the tube setter.
4) Recover supernatants or pellets. In case of the seal tubes, the sample recovery stand, which is an optional part showed in “Appendix 3”, is convenient when recovering.
5) Perform maintenance and inspection after use.

⚠ CAUTION

Perform maintenance and inspection of the rotor each time after using it. If you find abnormality in the rotor, stop using it and contact an authorized sales or service representative.

3.8 Fixing the screw-setting type rotors to the centrifuge and detaching

⚠ CAUTION

Do not use the screw-setting type rotors with the CS150NX and CS-FNX/CS-GXⅡ/CS-GXL/CS-GX series centrifuges.

- Fixing rotor

Fasten the rotor to the drive spindle with the rotor set handle (provided with the centrifuge). Set the switch to the down position (to turn clockwise), pressing down the rotor with the other hand. Imperfect tightening can cause damage to the rotor and the ultracentrifuge. The rotor set handle is of the ratchet type and it has a switch for changing the direction of rotation.

⚠ CAUTION

In case of the screw-setting type rotor, fasten it to the centrifuge securely. Otherwise the rotor might come off during the operation and it might damage the centrifuge and the rotor.

The torque wrench ass’y, which is an optional part as shown in Appendix 3, can tighten the screw certainly by the mark's matching.

- Detaching rotor

Loosen the rotor with the rotor set handle whose switch set to the up position (to turn counterclockwise), holding the rotor by hand.

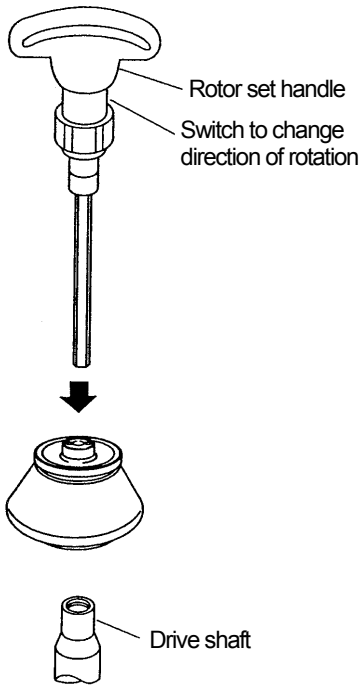


Fig. 3-11 Fixing rotor to drive spindle

3.9 How to use Cover Opener 3

The cover opener 3 is used for the cover of angle rotor for micro ultracentrifuges: If the cove is so tight after rotor operation that it is difficult to remove, with the cover opener 3 it can be easily opened.

(1) External view of cover opener 3

The exterior of the cover opener 3 is shown on the right. It has chucking portions on both surface and back face: Use them to match the size of cover. The material is polypropylene (PP).

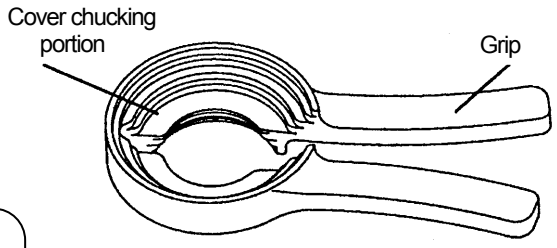


Fig. 3-12 External View of Cover Opener 3

⚠ CAUTION

Refer to "Chemical Resistance Chart" supplied with rotor, and take care that no sample that is specified unavailable adheres to rotor: This could damage the rotor by deterioration of material.

(2) How to use

1) Place the rotor after operation on rotor vise, taking care that the separation layer is not disturbed.
2) Use the cover chucking portion of cover opener 3 to grip the outer diameter of cover.
3) While depressing the cover opener 3 from top with the other hand, turn the cover opener 3 in the direction of the arrow (counterclockwise) as shown on the right.
4) Remove the cover, and then remove the samples.

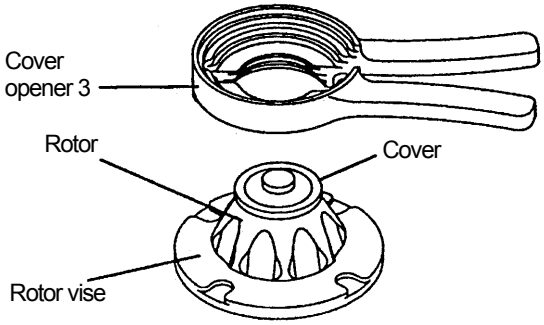


Fig. 3-13 Components When Removing Cover

⚠ CAUTION

- Take great care when handling cover opener 3 that your palm is not caught by its grip.
- Cover opener 3 cannot be used for S100AT3 rotors.



Fig. 3-14 Removing Cover

(3) Cleaning, sterilization and inspection

1) Cleaning

If dirt adheres to the opener, rinse it away with tap water, warm water or diluted solution of pH5-9 neutral detergent. Dry the opener in the air after cleaning.

2) Sterilization

If sterilizing the opener is necessary, use gas (ethylene oxide, formaldehyde) or chemicals (70% ethanol, 3% hydrogen peroxide, formalin).

⚠ CAUTION

Never autoclave or boil the cover opener 3. Otherwise the cover opener 3 may be deformed and become unusable.

3) Inspection

Cover opener 3 is a limited-life item. Check it after each use: If damage, wear or crack is found in the opener, replace it.

3.10 Maintenance

(1) Cleaning

Do maintenance the rotor after every use to prevent corrosion.

- Ordinary maintenance

  Remove the packing (O-ring) from the rotor. Wash the rotor and the packing with tap water or dilute neutral detergent. Rinse it with distilled water. Wipe off water drops with soft cloth and dry the rotor up-side down. After drying, coat the rotor and the packing with the silicone grease (vacuum grease). Store the rotor in a dry place.

- After using corrosive samples

  Wash the rotor with flowing water for a while and then perform ordinary maintenance.

- If foreign matter adheres to the rotor

  Soak the rotor in warm water (40-50°C) for a while, and wash the inside of the tube cavities and the drive hole with a cleaning bar or a soft brush to remove foreign matter.

  If you cannot remove it, contact your sales agent.

⚠ CAUTION

In all cases, use neutral detergent of pH 5-9. Otherwise the aluminum alloy would be discolored and corroded.

(2) Sterilizing

Sterilizing the rotor with gas (ethylene oxide or formaldehyde) or chemical solution (70% ethanol, 3% hydrogen peroxide or 3% formalin). Do not autoclave the rotor or sterilize it in boiling water because its material may deteriorate and its strength may decrease.

Do not use ethylene oxide to sterilize covers of rotors other than the S140AT, S58A, S55A2, and S50A for the purpose of maintaining the strength of plastic material.

Sterilizing the packing (O-ring) with gas (ethylene oxide or formaldehyde) or chemical solution (70% ethanol, 3% hydrogen peroxide or 3% formalin). Do not autoclave the packing (O-ring) or sterilize it in boiling water because its material may deteriorate and its strength may decrease.

⚠ WARNING

Do not allow the temperature of the rotor to rise above 100°C because otherwise the material would become brittle.

⚠ CAUTION

- Do not dip the rotor (including buckets) and the packing (O-ring) in the formalin (3%) solution more than 2 hours.
- Check the packing (O-ring) after sterilizing. The packing (O-ring) may be damaged due to deterioration during operation. Replace the new one if the damage or the deterioration is observed.

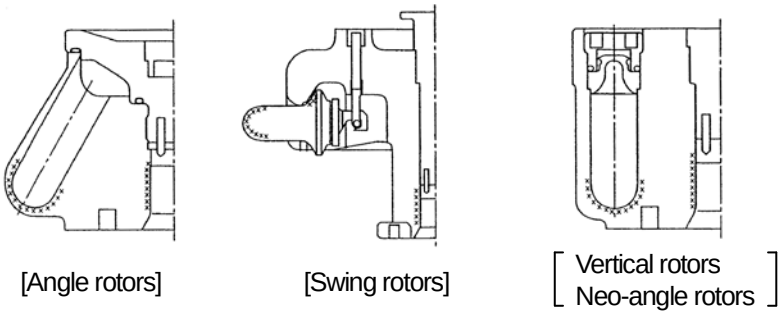
(3) Storage

Do not store the rotor, cover, and the packing (O-ring) in a chemical vapor or expose to UV radiation.

(4) Inspection

Check corrosion of rotor every 100 hours use. Particularly the tube cavity and the drive hole at the bottom of the rotor, the portion marked with XXX in the figure, decrease strength significantly if they are corroded.

So, check these portions well. The corroded status can be judged by the surface discoloration, concavity, crack, etc.. If you find corrosion, do not use the rotor and call your sales agent.



[Angle rotors] [Swing rotors] [Vertical rotors, Neo-angle rotors]

Fig. 3-15 Inspection points for corrosion

4. Decontamination

⚠ WARNING

- If the rotor or an accessory is contaminated by sample that are toxic or radioactive, 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 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 decontamination sheet attached the rotor 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 the part 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.

5. 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
Micro ultracentrifuge rotors	Titanium alloy	12
	Aluminum alloy	

Appendix 1. Calculation of Separation Characteristics

(1) Relationship between the relative centrifugal force and speed

The relative centrifugal force (RCF) generated by rotation is related to the speed and radial distance from the axis of rotation. The RCF is obtained from the following formula. Generally, the RCF is expressed as a ratio to the earth's gravitational acceleration and " x g" is used as a unit.

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

N : Speed (rpm)
r : Radial distance from the axis of rotation (cm)

The speed (rpm) can also be calculated from the RCF (× g) using this formula.

(2) To find the separation time

The sedimentation time T required for the particles scattered in the solution to lower from the top (r_t) to the bottom (r_b) of the tube. The sedimentation characteristic is expressed as sedimentation coefficient S, but generally the sedimentation coefficients s, becomes a very small value and s × 10^{13} may be indicated as S. This S expressed as s ×10^{13} is called the sedimentation coefficient in Svedberg units. However, in biochemistry, etc., it may simply be called the sedimentation coefficient.

$$T\ (hr) = \frac{\ln (r_b) - \ln (r_t)}{\omega^2} \cdot \frac{10^{13}}{3600 \times S}$$

ω : Angular velocity $\omega = \frac{2\pi}{60} \cdot N$
N : Speed (rpm)
r_t : Distance from axis of rotation to top of solution (cm)
r_b : Distance from axis of rotation to bottom of solution (cm)

Here, if it is defined that $K = \frac{\ln (r_b) - \ln (r_t)}{\omega^2} \cdot \frac{10^{13}}{3600}$

$$T\ (hr) = \frac{K}{S}$$

If S is unknown, the following formula (Stoke's low) is used for calculation.

$$S = \frac{d^2 (\rho_2 - \rho_1)}{18\eta} \times 10^{13}$$

d : Diameter of precipitating particle (cm)
ρ_1 : Density of solution surrounding particles (g/mL)
ρ_2 : Density of precipitating particles (g/mL)
η : Viscosity of solution surrounding particles (Poise)
(The viscosity of water at 20°C is 0.01 Poise.)

S in the pure water at 20°C is expressed as $S_{20.w.}$.

K is called K factor (clearing factor) which varies depending of the type of rotor and the speed. When the rotor is used at a certain speed, the K factor (K_N) can be obtained from the formula shown below.

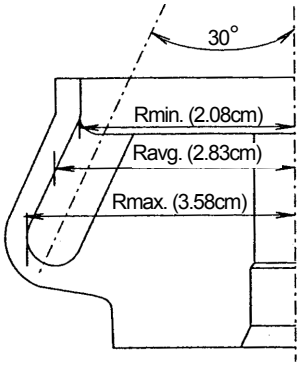
$$K_N = K \left(\frac{K_{max.}}{N} \right)^2$$

N : Speed used (rpm)
$N_{max.}$: Maximum speed (rpm)
K_N : K factor at the speed used
K : K factor at the maximum speed

Appendix 2. Rotor specifications

S150AT Angle rotor

Max. speed	150,000 rpm
Max. RCF	901,000 × g
Nominal rotor capacity	8mL = 8 × 1.0mL
k factor	6



(1) Summary of tubes

Tube				Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ × L cm)	Actual capacity (mL)	Part No.	Name		
S300535A	1 PC Tube	1.1 × 3.4	1.0	----	----	150,000	901,000
S300540A	2 PA Seal tube	1.1 × 3.1	1.8	S410387	Space cap (A4)	150,000	901,000
S300539A	1.5 PA Seal tube	1.1 × 2.4	1.2	S410387	Space cap (A4)	150,000	901,000
S309652A	1 PA Tube	1.1 × 3.4	0.8	----	----	86,000	296,000

(2) Standard accessories

Part No.	Name	Qty
S300535A	1 PC Tube	1 (100pcs./box)
84520204	O-ring	2
8062216	O-ring	2
452701	Tweezers	1
S410705A	Cover opener 3	1
Common accessories of all rotors (see Appendix 3)		1

NOTE : When using Seal tubes, the following optional accessories are required.

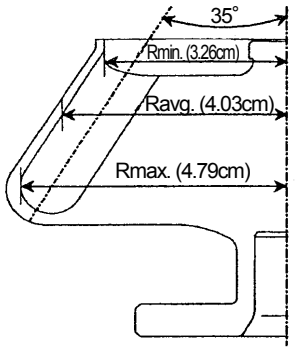
●2 PA Seal tube
- (a) S300540A 2 PA Seal tube ..... 1(50pcs./box)
- (b) S410387 Space cap (A4) 8
- (c) STF3 Tube sealer 1
- (d) S201778F Tube rack (G) 1
- (e) S407157 Tube setter 1

●1.5 PA Seal tube
- (a) S300539A 1.5 PA Seal tube ..... 1(50pcs./box)
- (b) S410387 Space cap (A4) 8
- (c) STF3 Tube sealer 1
- (d) S201778G Tube rack (G2) 1
- (e) S407157 Tube setter 1

(3) Characteristics table

Speed (rpm)	RCF (× g)			k factor
	Rmin. (2.08cm)	Ravg. (2.83cm)	Rmax. (3.58cm)	
10,000	2,330	3,160	4,000	1,375
20,000	9,300	12,700	16,000	344
30,000	20,900	28,500	36,000	153
40,000	37,200	50,600	64,000	86
50,000	58,100	79,100	100,000	55
60,000	83,700	114,000	144,000	38
70,000	114,000	155,000	196,000	28
80,000	149,000	202,000	256,000	21
90,000	188,000	256,000	324,000	17
100,000	233,000	316,000	400,000	14
110,000	281,000	383,000	484,000	11
120,000	335,000	456,000	576,000	10
130,000	393,000	535,000	676,000	8
140,000	456,000	620,000	784,000	7
150,000	523,000	712,000	901,000	6

S140AT Angle rotor



Max. speed	140,000 rpm
Max. RCF	1,050,000 × g
Nominal rotor capacity	10mL = 10 × 1.0mL
k factor	5

(1) Compatible tubes

Tube				Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ × L cm)	Actual capacity (mL)	Part No.	Name		
S300535A	1 PC Tube	1.1 × 3.4	1.0	——	——	140,000	1,050,000
S300540A	2 PA Seal tube	1.1 × 3.1	1.8	S410387	Space cap (A4)	140,000	1,050,000
S300539A	1.5 PA Seal tube	1.1 × 2.4	1.2	S410387	Space cap (A4)	140,000	1,050,000
S309652A	1 PA Tube	1.1 × 3.4	0.8	——	——	86,000	396,000

(2) Standard accessories

Part No.	Name	Qty
S300535A	1 PC Tube	1 (100pcs./box)
S410244	O-ring	2
452701	Tweezers	1
S410705A	Cover opener 3	1
Common accessories of all rotors (see Appendix 3)		1

NOTE : When using Seal tubes, the following optional accessories are required.

●2 PA Seal tube
(a) S300540A 2 PA Seal tube ..... 1(50pcs./box)
(b) S410387 Space cap (A4) 10
(c) STF3 Tube sealer 1
(d) S201778F Tube rack (G) 1
(e) S407157 Tube setter 1

●1.5 PA Seal tube
(a) S300539A 1.5 PA Seal tube ..... 1(50pcs./box)
(b) S410387 Space cap (A4) 10
(c) STF3 Tube sealer 1
(d) S201778G Tube rack (G2) 1
(e) S407157 Tube setter 1

(3) Characteristic table

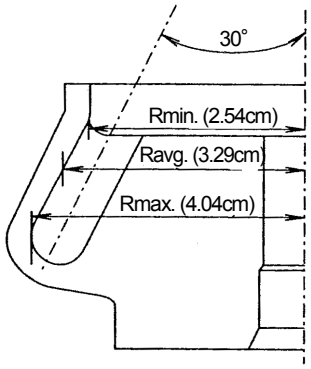
Speed (rpm)	RCF (× g)			k factor
	Rmin. (3.26cm)	Ravg. (4.03cm)	Rmax. (4.79cm)	
10,000	3,640	4,510	5,360	975
20,000	14,600	18,000	21,400	244
30,000	32,800	40,500	48,200	108
40,000	58,300	72,100	85,700	61
50,000	91,100	113,000	134,000	39
60,000	131,000	162,000	193,000	27
70,000	179,000	221,000	262,000	20
80,000	233,000	288,000	343,000	15
90,000	295,000	365,000	434,000	12
100,000	364,000	451,000	536,000	10
110,000	441,000	545,000	648,000	8
120,000	525,000	649,000	771,000	7
130,000	616,000	761,000	905,000	6
140,000	714,000	883,000	1,050,000	5

⚠ CAUTION

Note that this quick setting type rotor can be used only with the CS150NX and CS-FNX/CS-GX Ⅱ /CS-GXL/CS-GX series centrifuges.

S120AT2 Angle rotor

Max. speed	120,000 rpm
Max. RCF	650,000 × g
Nominal rotor capacity	10mL = 10 × 1.0mL
k factor	8



(1) Summary of tubes

Tube				Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ × L cm)	Actual capacity (mL)	Part No.	Name		
S300535A	1 PC Tube	1.1×3.4	1.0	-----	-----	120,000	650,000
S300540A	2 PA Seal tube	1.1×3.1	1.8	S410387	Space cap (A4)	120,000	650,000
S300539A	1.5 PA Seal tube	1.1×2.4	1.2	S410387	Space cap (A4)	120,000	650,000
S309652A	1 PA Tube	1.1×3.4	0.8	-----	-----	86,000	334,000

(2) Standard accessories

Part No.	Name	Qty
S300535A	1 PC Tube	1 (100pcs./box)
S407447	O-ring	2
8062216	O-ring	2
452701	Tweezers	1
S410705A	Cover opener 3	1
Common accessories of all rotors (see Appendix 3)		1

NOTE : When using Seal tubes, the following optional accessories are required.

●2 PA Seal tube
- (a) S300540A 2 PA Seal tube ..... 1(50pcs./box)
- (b) S410387 Space cap (A4) 10
- (c) STF3 Tube sealer 1
- (d) S201778F Tube rack (G) 1
- (e) S407157 Tube setter 1

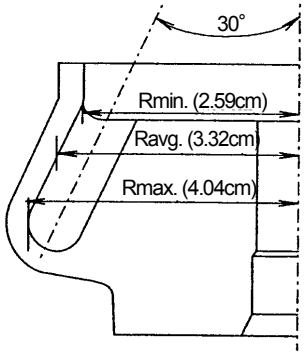
●1.5 PA Seal tube
- (a) S300539A 1.5 PA Seal tube ..... 1(50pcs./box)
- (b) S410387 Space cap (A4) 10
- (c) STF3 Tube sealer 1
- (d) S201778G Tube rack (G2) 1
- (e) S407157 Tube setter 1

(3) Characteristics table

Speed (rpm)	RCF (× g)			k factor
	Rmin. (2.54cm)	Ravg. (3.29cm)	Rmax. (4.04cm)	
10,000	2,840	3,680	4,520	1,176
20,000	11,400	14,700	18,100	294
30,000	25,600	33,100	40,700	131
40,000	45,400	58,900	72,300	73
50,000	71,000	92,000	113,000	47
60,000	102,000	132,000	163,000	33
70,000	139,000	180,000	221,000	24
80,000	182,000	235,000	289,000	18
90,000	230,000	298,000	366,000	15
100,000	284,000	368,000	452,000	12
110,000	344,000	445,000	547,000	10
120,000	409,000	530,000	650,000	8

S120AT3 Angle rotor

Max. speed	120,000 rpm
Max. RCF	650,000 × g
Nominal rotor capacity	7mL = 14 × 0.5mL
k factor	8



(1) Summary of tubes

Tube				Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ × L cm)	Actual capacity (mL)	Part No.	Name		
S300533A	0.5 PC Tube	0.8×3.4	0.5	——	——	120,000	650,000
S300534A	0.5 PA Tube	0.8×3.4	0.5	——	——	80,000	289,000

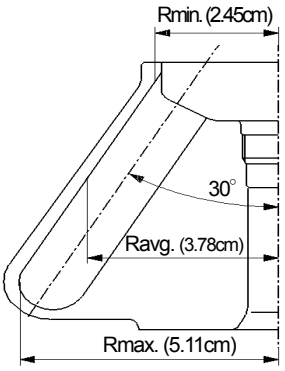
(2) Standard accessories

Part No.	Name	Qty
S300533A	0.5 PC Tube	1 (100pcs./box)
S407447	O-ring	2
8062216	O-ring	2
452701	Tweezers	1
S410705A	Cover opener 3	1
Common accessories of all rotors (see Appendix 3)		1

(3) Characteristics table

Speed (rpm)	RCF (× g)			k factor
	Rmin. (2.59cm)	Ravg. (3.32cm)	Rmax. (4.04cm)	
10,000	2,900	3,710	4,520	1,126
20,000	11,600	14,800	18,100	282
30,000	26,100	33,400	40,700	125
40,000	46,300	59,400	72,300	70
50,000	72,400	92,800	113,000	45
60,000	104,000	134,000	163,000	31
70,000	142,000	182,000	221,000	23
80,000	185,000	238,000	289,000	18
90,000	235,000	301,000	366,000	14
100,000	290,000	371,000	452,000	11
110,000	350,000	449,000	547,000	9
120,000	417,000	534,000	650,000	8

S110AT Angle rotor



Max. speed	110,000 rpm
Max. RCF	691,000 × g
Nominal rotor capacity	32mL = 8 × 4.0mL
k factor	15

(1) Summary of tubes

Tube				Space cap or Spacer		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ × L cm)	Actual capacity (mL)	Part No.	Name		
S404332A	4 PC Tube	1.3×6.0	3.4	-----	-----	110,000	691,000
S303351A	4 PA Thick-walled tube	1.3×6.0	3.4	-----	-----	80,000	366,000
S413529A	5TI Tube	1.3×6.0	4.5	-----	-----	65,000	241,000
345319A	5 PA Seal tube	1.3×5.3	5.1	S404331	B4–Space cap	110,000	691,000
S308892A	Micro tube 1.5mL	1.09×4.0	1.3	-----	-----	48,000	103,000
84710901	Sampling tube 1.5mL	1.08×4.2	1.3	-----	-----	48,000	103,000
-----	1.5mL Micro tube	1.1×4.2	1.0	-----	-----	48,000	103,000

(2) Standard accessories

Part No.	Name	Qty
S404332A	4 PC Tube	2 (50pcs./box)
S402618	Cover packing	2
8062216	O-ring	2
452701	Tweezers	1
S410705A	Cover opener 3	1
Common accessories of all rotors (see Appendix 3)		1

NOTE : When using Seal tubes or 1.5mL Micro tubes, the following optional accessories are required.

- 5 PA Seal tube
  - (a) 345319A 5 PA Seal tube ..... 1(50pcs./box)
  - (b) S404331 B4-Space cap 8
  - (c) STF3 Tube sealer 1
  - (d) S201778A Tube rack (B) 1
  - (e) S407157 Tube setter 1
- 1.5mL Micro tube
  - (a) S406389 1.5 A5 Adapter 4

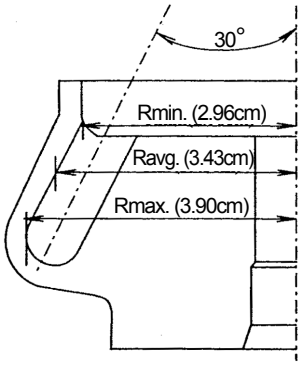
  *Use 1.5mL micro tube by four or less.

(3) Characteristics table

Speed (rpm)	RCF (× g)			k factor
	Rmin. (2.45cm)	Ravg. (3.78cm)	Rmax. (5.11cm)	
10,000	2,740	4,230	5,710	1,862
20,000	11,000	16,900	22,900	466
30,000	24,700	38,000	51,400	207
40,000	43,800	67,600	91,400	116
50,000	68,500	106,000	143,000	74
60,000	98,600	152,000	206,000	52
70,000	134,000	207,000	280,000	38
80,000	175,000	270,000	366,000	29
90,000	222,000	342,000	463,000	23
100,000	274,000	423,000	571,000	19
110,000	331,000	511,000	691,000	15

S100AT3 Angle rotor

Max. speed	100,000 rpm
Max. RCF	436,000 × g
Nominal rotor capacity	4.6mL=20 × 0.23mL
k factor	7



(1) Summary of tubes

Tube				Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ× L cm)	Actual capacity (mL)	Part No.	Name		
339133A	0.23 PC Tube	0.7×2.1	0.2	——	——	100,000	436,000
339675A	0.23 PA Tube	0.7×2.1	0.2	——	——	80,000	279,000

(2) Standard accessories

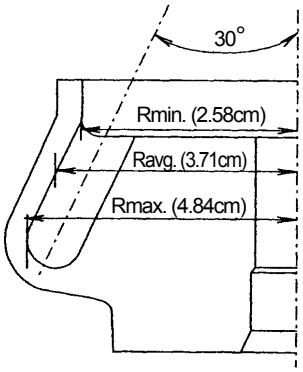
Part No.	Name	Qty
339133A	0.23 PC Tube	1 (100pcs./box)
8062260	O-ring	2
8062214	O-ring	2
452701	Tweezers	1
S406618	Cover opener	1
Common accessories of all rotors (see Appendix 3)		1

(3) Characteristics table

Speed (rpm)	RCF (× g)			k factor
	Rmin. (2.96cm)	Ravg. (3.43cm)	Rmax. (3.90cm)	
10,000	3,310	3,830	4,360	699
20,000	13,200	15,300	17,400	175
30,000	29,800	34,500	39,200	78
40,000	52,900	61,400	69,800	44
50,000	82,700	95,900	109,000	28
60,000	119,000	138,000	157,000	19
70,000	162,000	188,000	214,000	14
80,000	212,000	245,000	279,000	11
90,000	268,000	311,000	353,000	9
100,000	331,000	383,000	436,000	7

S100AT4 Angle rotor

Max. speed	100,000 rpm
Max. RCF	541,000 × g
Nominal rotor capacity	18mL = 6 × 3.0mL
k factor	16



(1) Summary of tubes

Tube				Space cap or Spacer		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ× L cm)	Actual capacity (mL)	Part No.	Name		
S301599A	3 PC Tube	1.3×5.1	2.7	-----	-----	100,000	541,000
S303350A	3 PA Thick-walled tube	1.3×5.1	2.7	-----	-----	85,000	391,000
S303694A	4 PA Seal tube	1.3×3.8	3.6	S404331	B4-Space cap	100,000	541,000
S308892A	Micro tube 1.5mL	1.09×4.0	1.3	-----	-----	50,000	112,000
84710901	Sampling Tube 1.5mL	1.08×4.2	1.3	-----	-----	50,000	112,000
-----	1.5mL Micro tube	1.1×4.2	1.0	-----	-----	50,000	112,000

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(2) Standard accessories

Part No.	Name	Qty
S301599A	3 PC Tube	2 (50pcs./box)
8062250	O-ring	2
8062216	O-ring	2
452701	Tweezers	1
S410705A	Cover opener 3	1
Common accessories of all rotors (see Appendix 3)		1

NOTE : When using Seal tubes or 1.5mL Micro tubes, the following optional accessories are required.

●4 PA Seal tube
- (a) S303694A 4 PA Seal tube ..... 1(50pcs./box)
- (b) S404331 B4-Space cap 6
- (c) STF3 Tube sealer 1
- (d) S201778H Tube rack (B3) 1
- (e) S407157 Tube setter 1

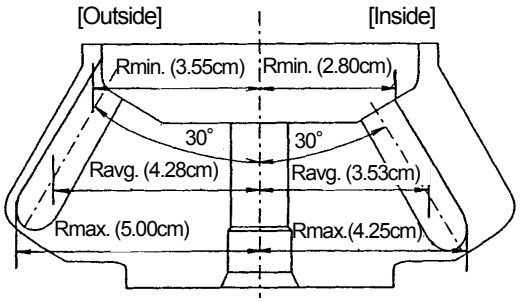
●1.5mL micro tube
- (a) S403444 1.5 A3 Adapter 6

(3) Characteristics table

Speed (rpm)	RCF (× g)			k factor
	Rmin. (2.58cm)	Ravg. (3.71cm)	Rmax. (4.84cm)	
10,000	2,880	4,150	5,410	1,594
20,000	11,500	16,600	21,600	398
30,000	26,000	37,300	48,700	177
40,000	46,200	66,400	86,600	100
50,000	72,100	104,000	135,000	64
60,000	104,000	149,000	195,000	44
70,000	141,000	203,000	265,000	33
80,000	185,000	265,000	346,000	25
90,000	234,000	336,000	438,000	20
100,000	288,000	415,000	541,000	16

S80AT2 Angle rotor

Max. speed	80,000 rpm
Max. RCF	358,000 × g
Nominal rotor capacity	15mL = 30 × 0.5mL
k factor	14



(1) Summary of tubes

Tube				Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ × L cm)	Actual capacity (mL)	Part No.	Name		
S300533A	0.5 PC Tube	0.8 × 3.4	0.5	-----	-----	80,000	358,000
S300534A	0.5 PA Tube	0.8 × 3.4	0.5	-----	-----	80,000	358,000

(2) Standard accessories

Part No.	Name	Qty
S300533A	0.5 PC Tube	1 (100pcs./box)
S4040544	O-ring	2
8062216	O-ring	2
452701	Tweezers	1
S410705A	Cover opener 3	1
Common accessories of all rotors (see Appendix 3)		1

(3) Characteristics table

[Inside]

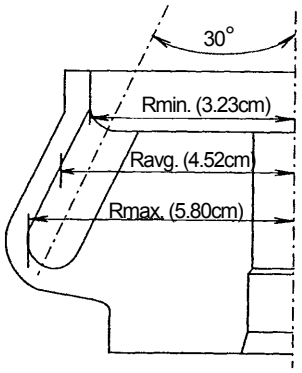
Speed (rpm)	RCF (× g)			k factor
	Rmin. (2.80cm)	Ravg. (3.53cm)	Rmax. (4.25cm)	
10,000	3,130	3,950	4,750	1,057
20,000	12,500	15,800	19,000	264
30,000	28,200	35,500	42,800	117
40,000	50,100	63,100	76,000	66
50,000	78,300	98,700	119,000	42
60,000	113,000	142,000	171,000	29
70,000	153,000	193,000	233,000	22
80,000	200,000	253,000	304,000	17

[Ouside]

Speed (rpm)	RCF (× g)			k factor
	Rmin. (3.55cm)	Ravg. (4.28cm)	Rmax. (5.00cm)	
10,000	3,970	4,790	5,590	868
20,000	15,900	19,100	22,400	217
30,000	35,700	43,100	50,300	96
40,000	63,500	76,600	89,400	54
50,000	99,200	120,000	140,000	35
60,000	143,000	172,000	201,000	24
70,000	194,000	234,000	274,000	18
80,000	254,000	306,000	358,000	14

S80AT3 Angle rotor

Max. speed	80,000 rpm
Max. RCF	415,000 × g
Nominal rotor capacity	48mL=8 × 6.0mL
k factor	23



(1) Summary of tubes

Tube				Adapter/Float spacer		Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ × L cm)	Actual capacity (mL)	Part No.	Name	Part No.	Name		
S408829A	6 PC Thick-walled tube	1.6×5.9	5.3	——	——	——	——	80,000	415,000
S408833A	6 PA Thick-walled tube	1.6×5.9	5.3	——	——	——	——	60,000	233,000
S408831A	8 PA Seal tube	1.6×5.3	8.3	——	——	S408835	Space cap (C5)	80,000	415,000
S311555A	6 PA Seal tube	1.6×5.0	6.5	S413978	C8-6 Float spacer	S408835	Space cap (C5)	80,000	415,000
S308892A	Micro tube 1.5mL	1.09×4.0	1.3			——	——	45,000	106,000
84710901	Sampling tube 1.5mL	1.08×4.2	1.3			——	——	45,000	106,000
——	1.5mL Micro tube	1.1×4.2	1.0			——	——	45,000	106,000

(2) Standard accessories

Part No.	Name	Qty
S408829A	6 PC Thick-walled tube	2 (50pcs./box)
8062260	O-ring	2
8062216	O-ring	2
452701	Tweezers	1
S410705A	Cover opener 3	1
Common accessories of all rotors (see Appendix 3)		1

(3) Characteristics table

Speed (rpm)	RCF (× g)			k factor
	Rmin. (3.23cm)	Ravg. (4.52cm)	Rmax. (5.80cm)	
10,000	3,610	5,050	6,480	1,483
20,000	14,400	20,200	25,900	371
30,000	32,500	45,500	58,400	165
40,000	57,800	80,900	104,000	93
50,000	90,300	126,000	162,000	59
60,000	130,000	182,000	233,000	41
70,000	177,000	248,000	318,000	30
80,000	231,000	323,000	415,000	23

NOTE : When using Seal tubes or 1.5mL Micro tubes, the following optional accessories are required.

●8 PA Seal tube kit (part no. S311562A)
(a) S408831A 8 PA Seal tube ..... 2(50pcs./box)
(b) S408835 Space cap(C5)..... 8
(c) S407157 Tube setter 1

*If you do not have a Tube sealer, the following parts are also necessary.
●STF3 Tube sealer
●Tube rack (C2) (S201778L)

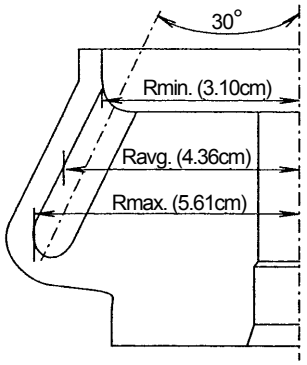
●6 PA Seal tube kit (part no. S311557B)
(a) S311555A 6 PA Seal tube.....1(50pcs./box)
(b) S408835 Space cap(C5) 8
(c) S413978 C8-6 Float spacer.....8
(d) S407157 Tube setter.....1

*If you do not have a Tube sealer, the following parts are also necessary.
●STF3 Tube sealer
●Tube rack (C4) (S206017A)

●1.5mL micro tube
(a) S408939 1.5A8 Adapter.....8

S70AT Angle rotor

Max. speed	70,000 rpm
Max. RCF	307,000 × g
Nominal rotor capacity	10mL=20 × 0.5mL
k factor	31



(1) Summary of tubes

Tube				Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ × L cm)	Actual capacity (mL)	Part No.	Name		
S302371A	0.5 PC Tube (B)	0.7×5.6	0.5	——	——	70,000	307,000

(2) Standard accessories

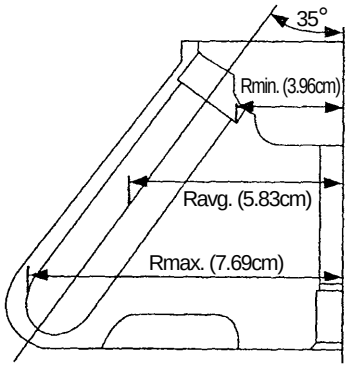
Part No.	Name	Qty
S302371A	0.5 PC Tube (B)	1 (100pcs./box)
8062256	O-ring	2
8062216	O-ring	2
452701	Tweezers	1
S410705A	Cover opener 3	1
Common accessories of all rotors (see Appendix 3)		1

(3) Characteristics table

Speed (rpm)	RCF (× g)			k factor
	Rmin. (3.10cm)	Ravg. (4.36cm)	Rmax. (5.61cm)	
10,000	3,470	4,870	6,270	1,502
20,000	13,900	19,500	25,100	376
30,000	31,200	43,900	56,400	167
40,000	55,500	78,000	100,000	94
50,000	86,600	122,000	157,000	60
60,000	125,000	175,000	226,000	42
70,000	170,000	239,000	307,000	31

S58A Angle rotor

Max. speed	58,000 rpm
Max. RCF	289,000 × g
Nominal rotor capacity	108mL=8 × 13.5mL
k factor	50



(1) Summary of tubes

Tube・Bottle					Adapter/Float Spacer		Cap		Maximum speed (rpm)	Maximum RCF (× g)
Nominal capacity	Part No.	Name	Size (ϕ× L cm)	Actual Capacity (mL)	Part No.	Name	Part No.	Name		
13.5	345320A	12PA Seal tube	1.6×7.8	13.5	--------		486582	C2 space cap	58,000	289,000
12	329606A	12PA Tube	1.6×7.6	10.5	--------		463577A	C-TI Cap Ass'y	58,000	289,000
				10.2			S410542A	S-12AL Cap Ass'y	58,000	289,000
	325470A	12PE Tube	1.6×7.5	10.5	--------		463577A	C-TI Cap Ass'y	58,000	289,000
				10.0			S410542A	S-12AL Cap Ass'y	58,000	289,000
	325751A	12PC Tube	1.6×7.6	10.5	--------		463577A	C-TI Cap Ass'y	58,000	289,000
	S413604A	12TI Tube	1.6×7.6	9.5	--------		--------		40,000	138,000
	326010A	12SST Tube	1.6×7.6	10.5	--------		463577A	C-TI Cap Ass'y	30,000	77,400
				9.5	--------		--------		35,000	105,000
10	338455A	10PC Thick-walled tube	1.6×7.7	7.3	--------		--------		58,000	289,000
	338456A	10PA Thick-walled tube	1.6×7.6	7.2	--------		--------		50,000	215,000
	S303922A	10PC Bottle (B) Ass'y	1.6×8.2	9.0	--------		--------		58,000	289,000
	325952A	10PC Bottle Ass'y	1.6×8.2	8.5	--------		--------		55,000	260,000
	334105A	10PA Bottle Ass'y	1.6×8.2	8.0	--------		--------		50,000	215,000
8	S408831A	8PA Seal tube	1.6×5.3	8.3	S413976	C12-8 Float Spacer	486582	C2 space cap	58,000	289,000
6.5	329445A	6.5PA Tube	1.3×6.4	5.8	336687A	6.5A12 Adapter	414429A	B-AL Cap Ass'y	38,000	114,000
	326415A	6.5PC Tube	1.3×6.4	5.8	336687A	6.5A12 Adapter	414429A	B-AL Cap Ass'y	38,000	114,000
6	S311555A	6PA Seal tube	1.6×4.2	6.5	S413977	C12-6 Float Spacer	486582	C2 space cap	58,000	289,000
5	332245A	5PA Tube	1.3×5.2	5	336686A	5A12 Adapter	414429A	B-AL Cap Ass'y	38,000	107,000
4.7	S303141A	4.7PC Thick-walled tube	1.3×6.4	3.4	336687A	6.5A12 Adapter	--------		38,000	114,000
4	329561A	4PA Tube	1.1×6.0	4	336685A	4A12 Adapter	336711A	A3-AL Cap Ass'y	38,000	117,000
3	336708A	3PA Tube	1.1×4.7	3	336684A	3A12 Adapter	336711A	A3-AL Cap Ass'y	38,000	109,000
	S301599A	3PC Tube	1.3×5.1	2.6	336686A	5A12 Adapter	--------		38,000	107,000
0.9	S304296A	0.9PC Thick-walled tube	0.8×5.0	0.9	336683A	2A12 Adapter	--------		42,000	151,000

(2) Standard accessories

Part No.	Name	Qty
338455A	10PC Thick-walled tube	2 boxes (10 tubes/box)
8062270	O-ring	2
8062014	O-ring	2
452701	Tweezers	1
Common accessories of all rotors (see Appendix 3)		1

⚠ WARNING

Do not run the rotor with samples whose average density is over 1.2 g/mL at the maximum speed.

⚠ CAUTION

Note that this quick setting type rotor can be used only with the CS150NX and CS-FNX/CS-GX Ⅱ /CS-GXL/CS-GX series centrifuges.

(3) Characteristics table

Speed (rpm)	RCF(×g)			k factor
	Rmin. (3.96cm)	Ravg. (5.83cm)	Rmax. (7.69cm)	
10,000	4,430	6,520	8,600	1,681
15,000	9,960	14,700	19,300	747
20,000	17,700	26,100	34,400	420
25,000	27,700	40,700	53,700	269
30,000	39,800	58,700	77,400	187
35,000	54,200	79,800	105,000	137
40,000	70,800	104,000	138,000	105
45,000	89,700	132,000	174,000	83
50,000	111,000	163,000	215,000	67
55,000	134,000	197,000	260,000	56
58,000	149,000	219,000	289,000	50

When using 8PA Seal tube, the following parts are required.

●8PA Seal tube kit (part no. S311562B)

[Components]

(a) S408831A 8PA Seal tube × 2 boxes (50 pcs./box)
(b) 486582 C2-space cap × 4
(c) S413976 C12-8 Float spacer × 4
(d) S407157 Tube setter × 1
(e) 435823A Tube setter (B) ass'y× 1

*If you do not have a Tube sealer, the following parts are also necessary.

●STF3 Tube sealer
●Tube rack (C2) (S201778L)

When using 6PA Seal tube, the following parts are required.

●6PA Seal tube kit (part no. S311557A)

[Components]

(a) S311555A 6PA Seal tube × 2 boxes (50 pcs./box)
(b) 486582 C2-space cap × 4
(c) S413977 C12-6 Float spacer × 4
(d) S407157 Tube setter × 1
(e) 435823A Tube setter (B) ass'y× 1

*If you do not have a Tube sealer, the following parts are also necessary.

●STF3 Tube sealer
●Tube rack (C4) (S206017A)

When using 12PA Seal tube, the following parts are required.

●12PA Seal tube kit (D) (part no. S304991D)

[Components]

(a) 345320A 12PA Seal tube × 2 boxes (50 pcs./box)
(b) 486582 C2-space cap × 8
(c) S407157 Tube setter × 1

*If you do not have a Tube sealer, the following parts are also necessary.

●STF3 Tube sealer
●Tube rack (C) (S201778B)

When using 12PA Tube, the following parts are required.

●12PA Tube kit (C) (part no.S304986C)

[Components]

(a) 329606A 12PA Tube × 2 boxes (50 pcs./box)
(b) 463577A C-TI cap × 8
(c) S401803A Packing for cap× 2 boxes (10 pcs./box)
(d) 333885A Tube vice (C2) × 1
(e) 469283 Torque wrench × 1
(f) 435823A Tube setter (B) ass'y × 1

When using C-TI caps for 12PE Tubes or 12PC Tubes or 12SST Tubes, the following parts are required.

●Tool set (C2) (part no.341109A)

[Components]

(a) 333885A Tube vice (C2) × 1
(b) 469283 Torque wrench × 1

●Tube setter(C) (part no. 481056A)

When using S-12AL Caps for 12PA Tubes or 12PE Tubes, the following parts are required.

A S-12AL Cap can not be used for a 12PC Tube.

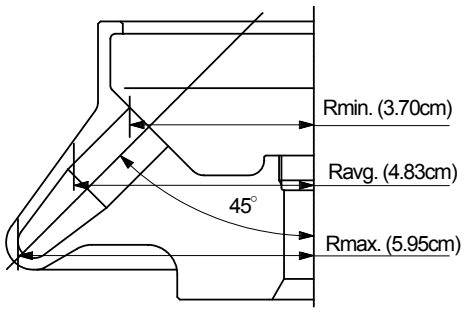
●S-12AL Cap tool set (part no.S308626A)

[Components]

(a) S410542A S-12AL Cap × 8
(b) S204591B Hand press × 1
(c) S411487 Tube holder(C) × 1
(d) S411486 Tube holder(E) × 1
(e) 481056A Tube setter(C) × 1

S55A2 Angle rotor

Max. speed	55,000 rpm
Max. RCF	201,000 × g
Nominal rotor capacity	18mL=12 × 1.5mL
k factor	40



(1) Summary of tubes

Tube				Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ × L cm)	Actual capacity (mL)	Part No.	Name		
S308892A	Micro tube1.5mL	1.09×4.0	1.3	-----	-----	55,000	201,000

(2) Standard accessories

Part No.	Name	Qty
S308892A	Micro tube1.5mL	1 (300pcs./box)
8062275	O-ring	2
8062014	O-ring	2
Common accessories of all rotors (see Appendix 3)		1

(3) Characteristics table

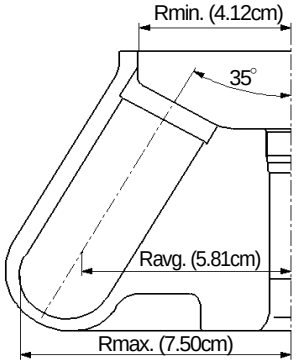
Speed (rpm)	RCF(×g)			k factor
	Rmin. (3.70cm)	Ravg. (4.83cm)	Rmax. (5.95cm)	
5,000	1,030	1,350	1,660	4,813
10,000	4,140	5,400	6,650	1,203
15,000	9,310	12,100	15,000	535
20,000	16,500	21,600	26,600	301
25,000	25,900	33,700	41,600	193
30,000	37,200	48,600	59,900	134
35,000	50,700	66,100	81,500	98
40,000	66,200	86,400	106,000	75
45,000	83,800	109,000	135,000	59
50,000	103,000	135,000	166,000	48
55,000	125,000	163,000	201,000	40

⚠ CAUTION

Note that this quick setting type rotor can be used only with the CS150NX and CS-FNX/CS-GXⅡ/CS-GXL/CS-GX series centrifuges.

S50A Angle rotor

Max. speed	50,000 rpm
Max. RCF	210,000 × g
Nominal rotor capacity	180mL = 6 × 30.0mL
k factor	61



(1) Summary of tubes

Tubes・Bottles					Adapters/Float Spacers		Caps		Maximum speed (rpm)	Maximum RCF (× g)
Nominal capacity	Part No.	Name	Size (ϕ× L cm)	Actual capacity (mL)	Part No.	Name	Part No.	Name		
30	S309154A	30 PA Tube	2.6×7.2	25.4	------		S410532A	S-40AL Cap Ass'y	50,000	210,000
				26.8	------		S305231A	E3-AL Cap Ass'y	50,000	210,000
	S311568A	30PA Seal tube	2.6×7.5	31.7	------		485649	E Space Cap	50,000	210,000
25	S309140A	25 PC Thick-walled tube	2.6×7.6	19.8	------		------		50,000	210,000
	S309155A	25 PA Thick-walled tube	2.6×7.6	19.8	------		------		30,000	76,000
20	S309156A	20 PC Bottle (C)	2.6×8.0	20.3	------		------		50,000	210,000
	S310163A	20 PA Bottle (C)*	2.6×8.0	19.0	------		------		50,000	210,000
	S311569A	20PA Seal tube	2.6×5.5	22.2	S413979	E40-30 Float Spacer	485649	E Space Cap	50,000	210,000

*When a 20PA Bottle (C) is used at more than 100,000xg (maximum RCF), liquid should be over the shoulder of the bottle.

(2) Standard accessories

Part No.	Name	Qty
S309140A	25 PC Thick-walled tube	2 (10pcs./box)
8062285	O-ring	2
8062014	O-ring	2
452701	Tweezers	1
Common accessories of all rotors (see Appendix 3)		1

(3) Characteristics table

Speed (rpm)	RCF(×g)			k factor
	Rmin. (4.12cm)	Ravg. (5.81cm)	Rmax. (7.50cm)	
5,000	1,150	1,620	2,100	6,070
10,000	4,610	6,500	8,390	1517
15,000	10,400	14,600	18,900	674
20,000	18,400	26,000	33,500	379
25,000	28,800	40,600	52,400	243
30,000	41,500	58,500	75,500	169
35,000	56,400	79,600	103,000	124
40,000	73,700	104,000	134,000	95
45,000	93,300	132,000	170,000	75
50,000	115,000	162,000	210,000	61

⚠ WARNING

Do not run the rotor with samples whose average density is over 1.2 g/mL at the maximum speed.

⚠ CAUTION

Note that this quick setting type rotor can be used only with the CS150NX and CS-FNX/CS-GX Ⅱ /CS-GXL/CS-GX series centrifuges.

When using S-40AL Caps for 30PA Tubes, the following parts are required.

- S-30AL Cap tool set (part no.S309145A)
  [Components]
  - (a) S410532A S-40AL Cap × 6
  - (b) S204591B Hand press × 1
  - (c) S412292 Tube holder(D) × 1
  - (d) 481056A Tube setter(C) × 1

When using E3-AL Caps for 30PA Tubes, the following parts are required.

- 30PA Tube kit (part no.S309245A)
  [Components]
  - (a) S309154A 30PA Tube × 2 boxes (50 pcs./box)
  - (b) S305231A E3-AL cap × 6
  - (c) S401787A Packing for cap× 2 boxes (10 pcs./box)
  - (d) S309247A Tube vice (D) × 1
  - (e) 477706 Socket adapter × 1
  - (f) 477705 Torque wrench× 1
  - (g) 483539A 17mm Socket × 1
  - (h) 435823A Tube setter × 1

When using 30PA Seal tube, the following parts are required.

- 30 PA Seal tube kit (part no. S311570A)
  - (a) S311568A 30 PA Seal tube ..... 2(50pcs./box)
  - (b) 485649 E Space cap..... 6
  - (c) S407157 Tube setter 1

*If you do not have a Tube sealer, the following parts are also necessary.

- STF3 Tube sealer
- Tube rack (E3) (S206017B)

When using 20PA Seal tube, the following parts are required.

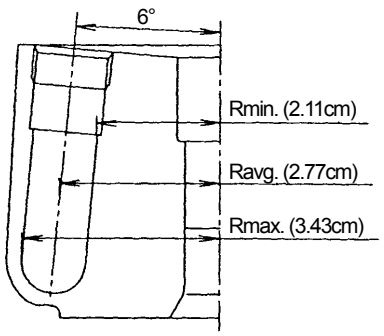
- 20 PA Seal tube kit (part no. S311571B)
  - (a) S311569A 20 PA Seal tube.....2(50pcs./box)
  - (b) 485649 E Space cap 6
  - (c) S413979 E40-30 Float spacer.....6
  - (d) S407157 Tube setter.....1
  - (e) 435823A Tube setter (B) ass'y 1

*If you do not have a Tube sealer, the following parts are also necessary.

- STF3 Tube sealer
- Tube rack (E4) (S206017C)

S140NT Neo-angle rotor

Max. speed	140,000 rpm
Max. RCF	752,000 × g
Nominal rotor capacity	16mL=8 × 2.0mL
k factor	6



(1) Summary of tubes

Tube				Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ × L cm)	Actual capacity (mL)	Part No.	Name		
S300540A	2 PA Seal tube	1.1×3.1	1.8	S406695	Space cap (A2)	140,000	752,000

(2) Standard accessories

Part No.	Name	Qty
S300540A	2 PA Seal tube	2 (50pcs./box)
S406695	Space cap (A2)	8
S402985	O-ring	16
S407157	Tube setter	1
S406341A	Handle C	1
Common accessories of all rotors (see Appendix 3)		1

NOTE : When using Seal tubes, the following optional accessories are required.

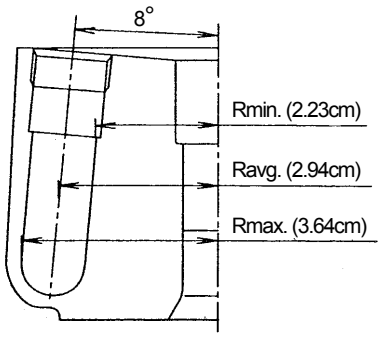
●2 PA Seal tube
(a) STF3 Tube sealer.....1
(b) S201778F Tube rack (G).....1

(3) Characteristics table

Speed (rpm)	RCF(×g)			k factor
	Rmin. (2.11cm)	Ravg. (2.77cm)	Rmax. (3.43 cm)	
10,000	2,360	3,100	3,830	1,231
20,000	9,440	12,400	15,300	308
30,000	21,200	27,900	34,500	137
40,000	37,700	49,500	61,400	77
50,000	59,000	77,400	95,900	49
60,000	84,900	111,000	138,000	34
70,000	116,000	152,000	188,000	25
80,000	151,000	198,000	245,000	19
90,000	191,000	251,000	311,000	15
100,000	236,000	310,000	383,000	12
110,000	285,000	375,000	464,000	10
120,000	340,000	446,000	552,000	9
130,000	399,000	523,000	648,000	7
140,000	462,000	607,000	752,000	6

S120NT Neo-angle rotor

Max. speed	120,000 rpm
Max. RCF	586,000 × g
Nominal rotor capacity	16mL=8 × 2.0mL
k factor	9



(1) Summary of tubes

Tube				Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ × L cm)	Actual capacity (mL)	Part No.	Name		
S300540A	2 PA Seal tube	1.1×3.1	1.8	S406695	Space cap (A2)	120,000	586,000

(2) Standard accessories

Part No.	Name	Qty
S300540A	2 PA Seal tube	2 (50pcs./box)
S406695	Space cap (A2)	8
S402985	O-ring	16
S407157	Tube setter	1
S406341A	Handle C	1
Common accessories of all rotors (see Appendix 3)		1

NOTE : When using Seal tubes, the following optional accessories are required.

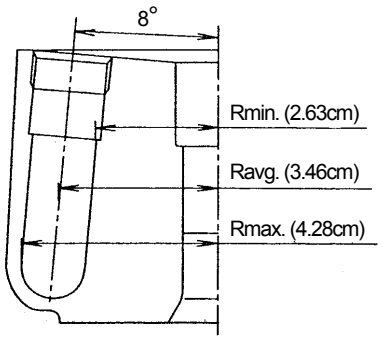
●2 PA Seal tube
(a) STF3 Tube sealer 1
(b) S201778F Tube rack (G) 1

(3) Characteristics table

Speed (rpm)	RCF(×g)			k factor
	Rmin. (2.23cm)	Ravg. (2.94cm)	Rmax. (3.64cm)	
10,000	2,490	3,290	4,070	1,241
20,000	9,970	13,100	16,300	310
30,000	22,400	29,600	36,600	138
40,000	39,900	52,600	65,100	78
50,000	62,300	82,200	102,000	50
60,000	89,800	118,000	147,000	34
70,000	122,000	161,000	199,000	25
80,000	160,000	210,000	260,000	19
90,000	202,000	266,000	330,000	15
100,000	249,000	329,000	407,000	12
110,000	302,000	398,000	492,000	10
120,000	359,000	473,000	586,000	9

S100NT Neo-angle rotor

Max. speed	100,000 rpm
Max. RCF	479,000 × g
Nominal rotor capacity	32mL=8 × 4.0mL
k factor	12



(1) Summary of tubes

Tube				Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ× L cm)	Actual capacity (mL)	Part No.	Name		
S303694A	4 PA Seal tube	1.3×3.8	3.6	488101	Space cap (B2)	100,000	479,000

(2) Standard accessories

Part No.	Name	Qty
S303694A	4 PA Seal tube	2 (50pcs./box)
488101	Space cap (B2)	8
488100	Cap packing	16
S407157	Tube setter	1
S401062A	Handle	1
Common accessories of all rotors (see Appendix 3)		1

NOTE : When using Seal tubes, the following optional accessories are required.

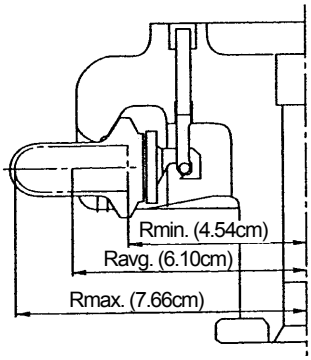
●4PA Seal tube
(a) STF3 Tube sealer.....1
(b) S201778H Tube rack (B3).....1

(3) Characteristics table

Speed (rpm)	RCF(×g)			k factor
	Rmin. (2.63cm)	Ravg. (3.46cm)	Rmax. (4.28cm)	
10,000	2,940	3,870	4,790	1,234
20,000	11,800	15,500	19,100	308
30,000	26,500	34,800	43,100	137
40,000	47,000	61,900	76,600	77
50,000	73,500	96,700	120,000	49
60,000	106,000	139,000	172,000	34
70,000	144,000	190,000	234,000	25
80,000	188,000	248,000	306,000	19
90,000	238,000	313,000	388,000	15
100,000	294,000	387,000	479,000	12

S55S Swing rotor

Max. speed	55,000 rpm
Max. RCF	259,000 × g
Nominal rotor capacity	8.8mL=4 × 2.2mL
k factor	44



(1) Summary of tubes

Tube				Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ × L cm)	Actual capacity (mL)	Part No.	Name		
S300536A	2.2 PA Tube	1.1×3.4	2.2	——	——	55,000	259,000
S300538A	2.2 PET Tube	1.1×3.4	2.2	——	——	55,000	259,000
S300535A	1 PC Tube	1.1×3.4	1.4	——	——	55,000	259,000

(2) Standard accessories

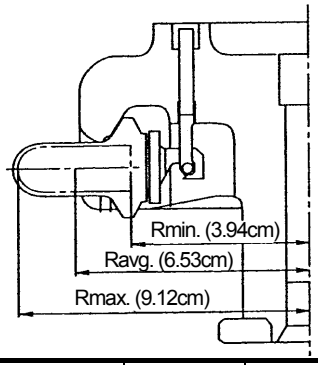
Part No.	Name	Qty
S300536A	2.2 PA Tube	2 (50pcs./box)
8062214	O-ring	8
474215	Cap spanner	1
S301310A	Bucket stand	1
452701	Tweezers	1
Common accessories of all rotors (see Appendix 3)		1

(3) Characteristics table

Speed (rpm)	RCF(×g)			k factor
	Rmin. (4.54cm)	Ravg. (6.10cm)	Rmax. (7.66cm)	
10,000	5,080	6,820	8,560	1,325
15,000	11,400	15,300	19,300	539
20,000	20,300	27,300	34,300	331
25,000	31,700	42,600	53,500	212
30,000	45,700	61,400	77,100	147
35,000	62,200	83,500	105,000	108
40,000	81,200	109,000	137,000	83
45,000	103,000	138,000	173,000	65
50,000	127,000	170,000	214,000	53
55,000	154,000	206,000	259,000	44

S52ST Swing rotor (Exclusive for the CS150NX and CS-FNX/CS-GXⅡ/CS-GXL series)

Max. speed	52,000 rpm
Max. RCF	276,000 × g
Nominal rotor capacity	20mL=4 × 5.0mL
k factor	79



(1) Summary of tubes

Tube				Adapter		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ× L cm)	Actual capacity (mL)	Part No.	Name		
332245A	5 PA Tube	1.3×5.2	4.9	——	——	52,000	276,000
S303273A	5 PET Tube	1.3×5.2	5.3	——	——	52,000	276,000
S301599A	3 PC Tube	1.3×5.1	3.4	——	——	52,000	276,000
S303350A	3 PA Thick-walled tube	1.3×5.1	3.4	——	——	52,000	276,000
S304296A	0.9 PC Thick-walled tube	0.8×5.0	0.9	336697A	2S5 adapter	43,000	183,000

When using 2S5 adapters in the S52ST swing rotor, run the rotor at 10℃ or less.

(2) Standard accessories

Part No.	Name	Qty
332245A	5 PA Tube	2 (50pcs./box)
8062216	O-ring	8
474215	Cap spanner	1
S305486A	Basket stand	1
452701	Tweezers	1
Common accessories of all rotors (see Appendix 3)		1

⚠ CAUTION

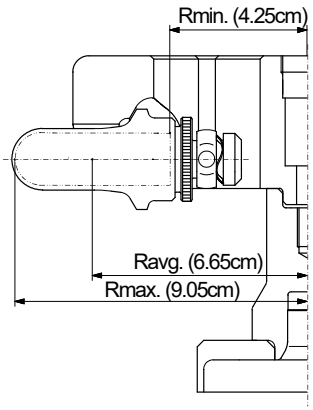
Note that this quick setting type rotor can be used only with the CS150NX and CS-FNX/CS-GXⅡ/CS-GXL series centrifuges.

(3) Characteristics table

Speed (rpm)	RCF(×g)			k factor
	Rmin. (3.94cm)	Ravg. (6.53cm)	Rmax. (9.12cm)	
10,000	4,400	7,300	10,200	2,126
15,000	9,910	16,400	22,900	945
20,000	17,600	29,200	40,800	531
25,000	27,500	45,600	63,700	340
30,000	39,600	65,700	91,800	236
35,000	54,000	89,400	125,000	174
40,000	70,500	117,000	163,000	133
45,000	89,200	148,000	206,000	105
50,000	110,000	183,000	255,000	85
52,000	119,000	197,000	276,000	79

S50ST Swing rotor (Exclusive for the CS150NX and CS-FNX/CS- GXⅡ/CS-GXL series)

Max. speed	50,000 rpm
Max. RCF	253,000 × g
Nominal rotor capacity	28mL=4 × 7.0mL
k factor	77



(1) Summary of tubes

Tube				Space Cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ × L cm)	Actual capacity (mL)	Part No.	Name		
S309146A	7 PA Tube (B)	1.6×5.2	7.0	-----	-----	50,000	253,000
S309167A	7 PC Tube (B)	1.6×5.2	7.0	-----	-----	50,000	253,000
S309168A	7 PET Tube	1.6×5.2	7.0	-----	-----	50,000	253,000
S311555A	6PA Seal Tube	1.6×4.2	6.5	S414518	Space cap (C7)	50,000	253,000

(2) Standard accessories

Part No.	Name	Qty
S309146A	7 PA Tube (B)	1 (50pcs./box)
8062220	O-ring	8
S305486B	Basket stand	1
452701	Tweezers	1
Common accessories of all rotors (see Appendix 3)		1

(3) Characteristics table

Speed (rpm)	RCF(×g)			k factor
	Rmin. (4.25cm)	Ravg. (6.65cm)	Rmax. (9.05cm)	
5,000	1,190	1,860	2,530	7,658
10,000	4,750	7,430	10,100	1,915
15,000	10,700	16,700	22,800	851
20,000	19,000	29,700	40,500	479
25,000	29,700	46,500	63,200	306
30,000	42,800	66,900	91,100	213
35,000	58,200	91,100	124,000	156
40,000	76,000	119,000	162,000	120
45,000	96,200	151,000	205,000	95
50,000	119,000	186,000	253,000	77

⚠ CAUTION

Note that this quick setting type rotor can be used only with the CS150NX and CS-FNX/CS-GXⅡ /CS-GXL series centrifuges.

When using 6PA Seal tube, the following parts are required.

- 6 PA Seal tube kit (part no. S311557C)
  - (a) S311555A 6 PA Seal tube.....2(50pcs./box)
  - (b) S414518 Space cap(C7).....4
  - (c) S407157 Tube setter 1

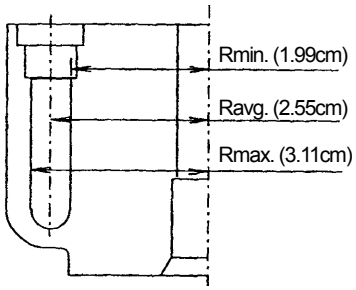
*If you need an additional cap included in 6PA Seal Tube kit, you will need to order an additional 6PA Seal Tube kit (Part No. S311557C).

*If you do not have a Tube sealer, the following parts are also necessary.

- STF3 Tube sealer
- Tube rack (C4) (S206017A)

S120VT Vertical rotor

Max. speed	120,000 rpm
Max. RCF	501,000 × g
Nominal rotor capacity	16mL=8 × 2.0mL
k factor	8



(1) Summary of tubes

Tube				Space cap		Maximum speed (rpm)	Maximum RCF (× g)
Part No.	Name	Size (ϕ× L cm)	Actual capacity (mL)	Part No.	Name		
S300540A	2 PA Seal tube	1.1×3.1	1.8	S406695	Space cap (A2)	120,000	501,000

(2) Standard accessories

Part No.	Name	Qty
S300540A	2 PA Seal tube	2 (50pcs./box)
S406695	Space cap (A2)	8
S402985	O-ring	16
S407157	Tube setter	1
S406341A	Handle C	1
Common accessories of all rotors (see Appendix 3)		1

NOTE : When using Seal tubes, the following optional accessories are required.

●2PA Seal tube

(a) STF3 Tube sealer.....1

(b) S201778F Tube rack (G).....1

⚠ CAUTION

Do not use the caps and the space caps for the RP120VT rotor with the S120VT rotor.

(3) Characteristics table

Speed (rpm)	RCF (×g)			k factor
	Rmin. (1.99cm)	Ravg. (2.55cm)	Rmax. (3.11cm)	
10,000	2,220	2,850	3,480	1,131
20,000	8,900	11,400	13,900	283
30,000	20,000	25,700	31,300	126
40,000	35,600	45,600	55,600	71
50,000	55,600	71,300	86,900	45
60,000	80,100	103,000	125,000	31
70,000	109,000	140,000	170,000	23
80,000	142,000	182,000	223,000	18
90,000	180,000	231,000	282,000	14
100,000	222,000	285,000	348,000	11
110,000	269,000	345,000	421,000	9
120,000	320,000	411,000	501,000	8

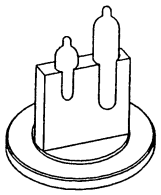
Appendix 3. Common Accessories and Optional Parts of Rotor

●Common Accessories

Part No.	Name	Qty	Remarks
S407982A	Rotor vise	1	For angle rotors For S120NT/S100NT neo-angle rotor For S120VT vertical rotor
S403073	Rotor stand (B)		For S58A/S50A angle rotor For S55S/S52ST/S50ST swing rotor
483719	Silicone grease (Vacuum grease)	1	
84810601	Lubricant for screw	1	
S205074	Tool box (C)	1	
S999276	Instruction manual	1	

●Optional parts of rotor

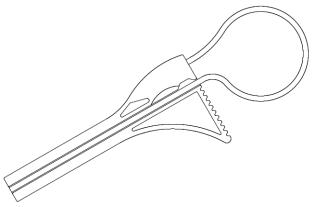
Undermentioned parts are not attached to the rotor. Please buy them separately.



· Sample Recovery Stand (Part No.S407906A)

It is a stand special to use when the sample is collected from the tubes.

It can be use with 1.5, 2, 3.5, 4 and 5 PA Seal tubes.

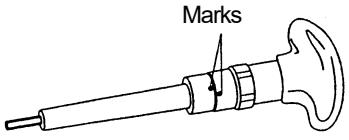


· Cover Opener 2 (Part No.S407846)

When the temperature of rotor is lower over 10°C than the operating temperature, detaching the cover of the rotor might become difficult. It is a tool it to be possible to detach easily in little power.

· Torque Wrench Ass'y (Part No.S305622A)

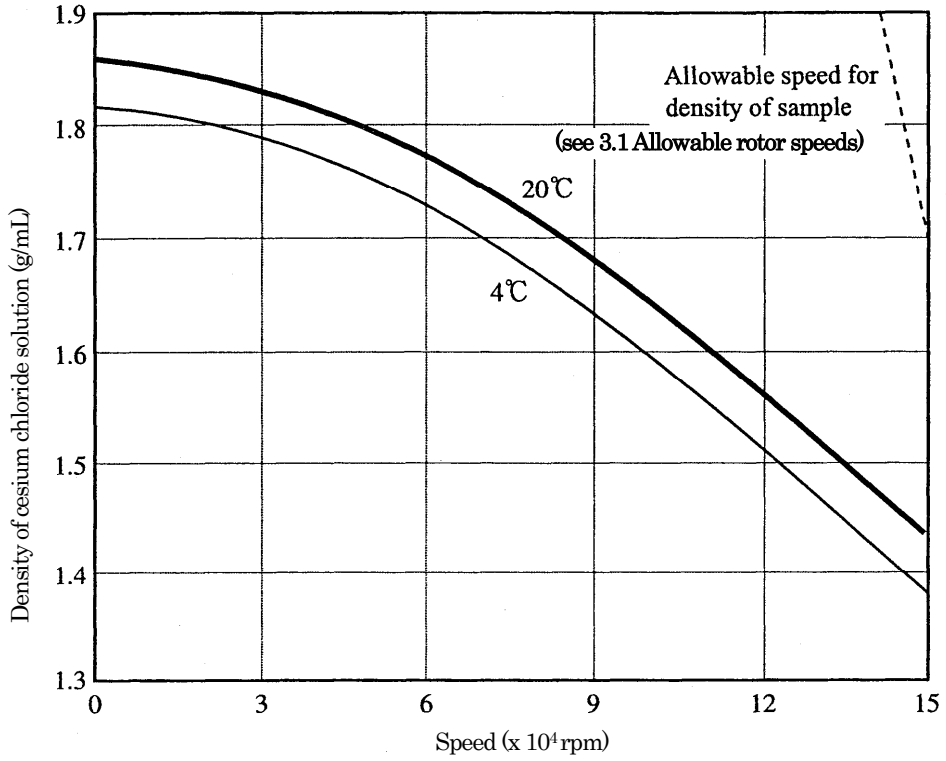
When the rotor is installed in the centrifuge, it is a torque wrench to tighten the screw. A necessary torque can be obtained by the mark's matching.



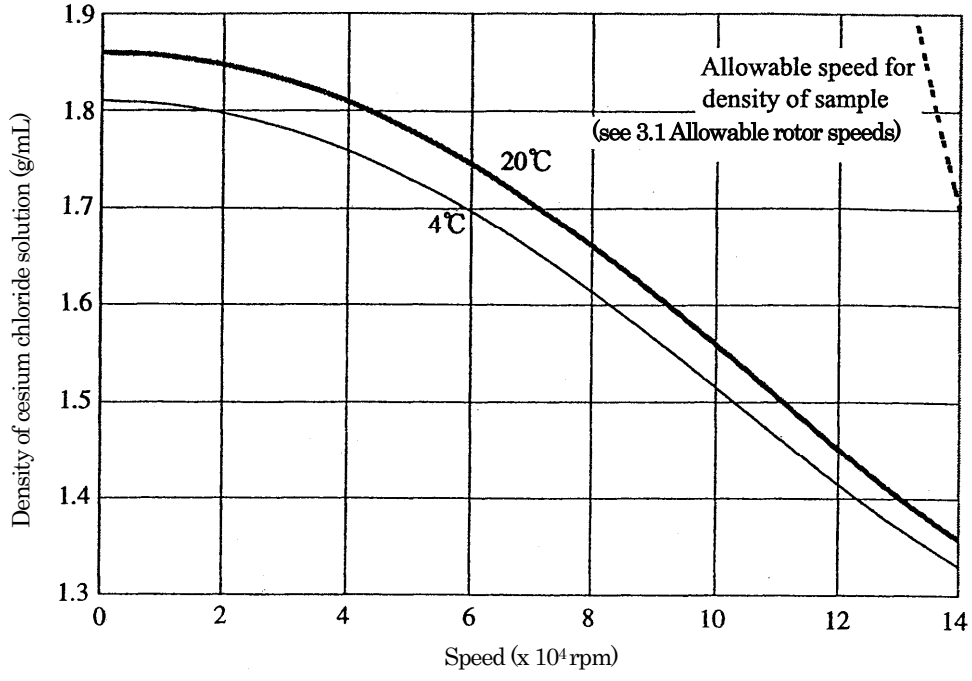
Appendix 4. Relationship between density of cesium chloride solution and speed

Drawings show the relationship between the maximum allowable density and the speed at which the sample does not crystallize in the condition that the tube is filled with cesium chloride solution. In this diagram, crystallization will occur above the curves in this diagram will vary at different temperatures, etc., centrifuge the cesium chloride solution with the same density to check that crystallization does not occur separation an important sample.

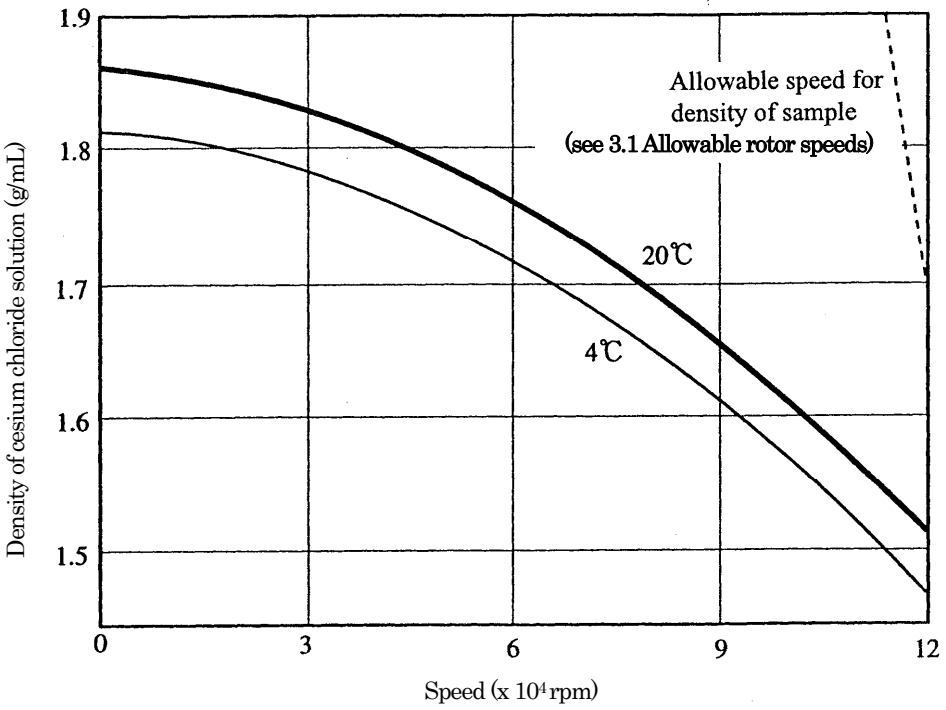
●S150AT Angle rotor



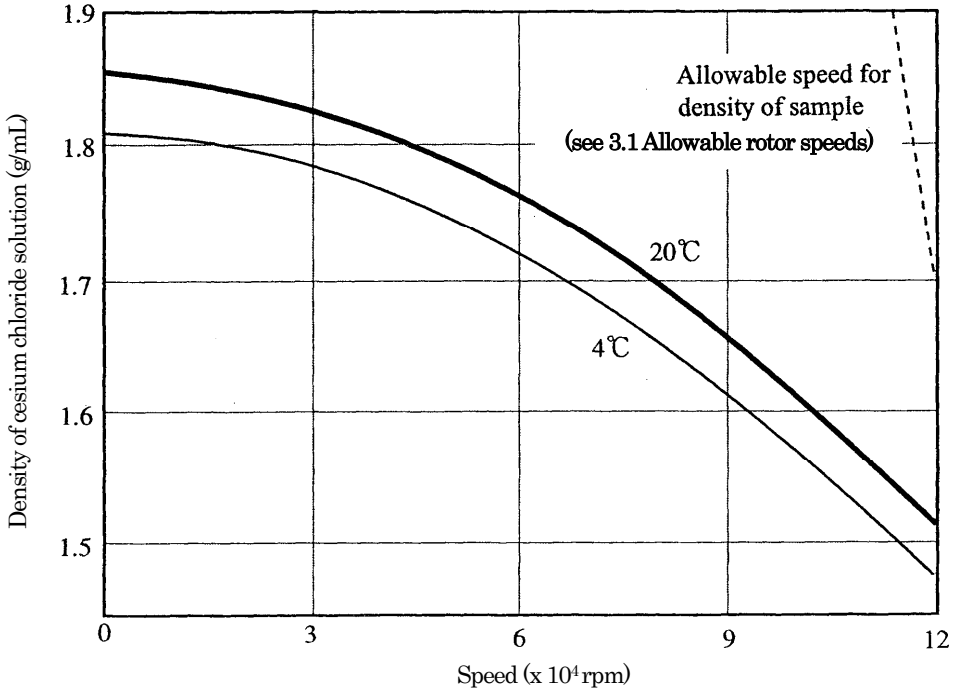
●S140AT Angle rotor



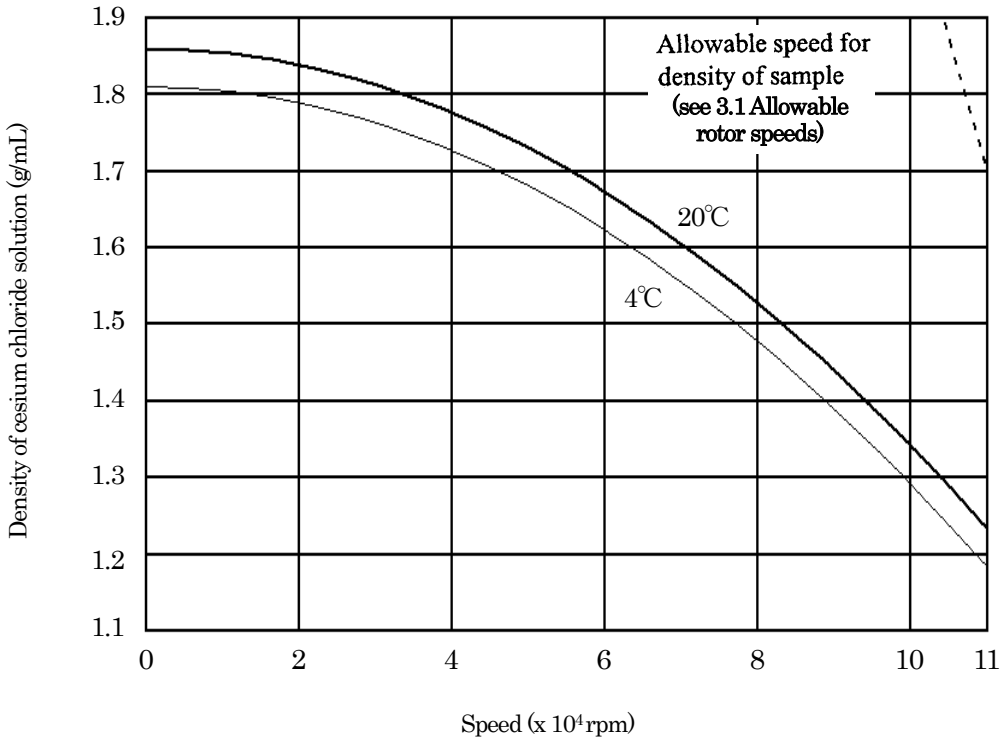
●S120AT2 Angle rotor



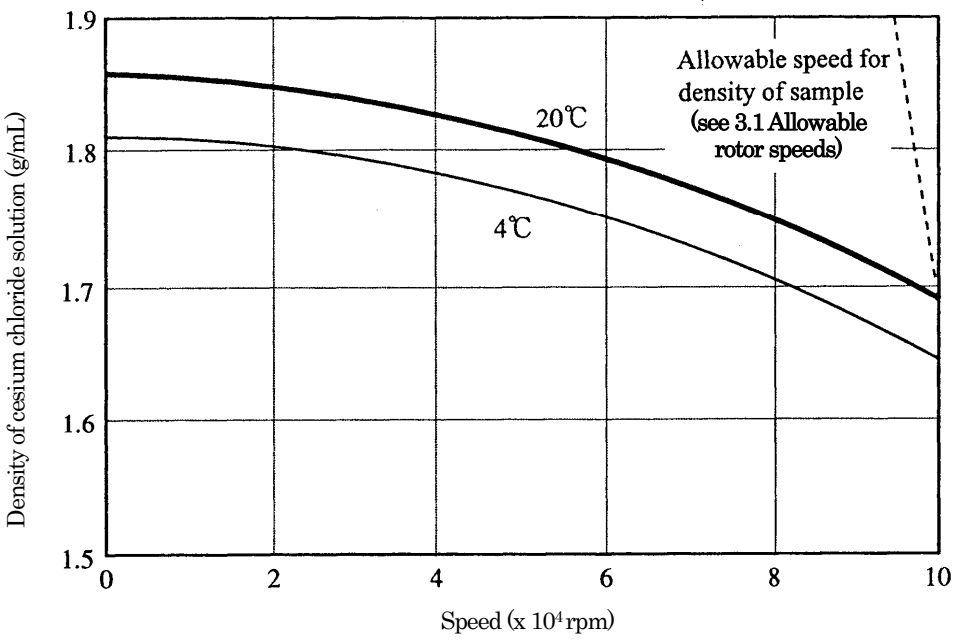
●S120AT3 Angle rotor



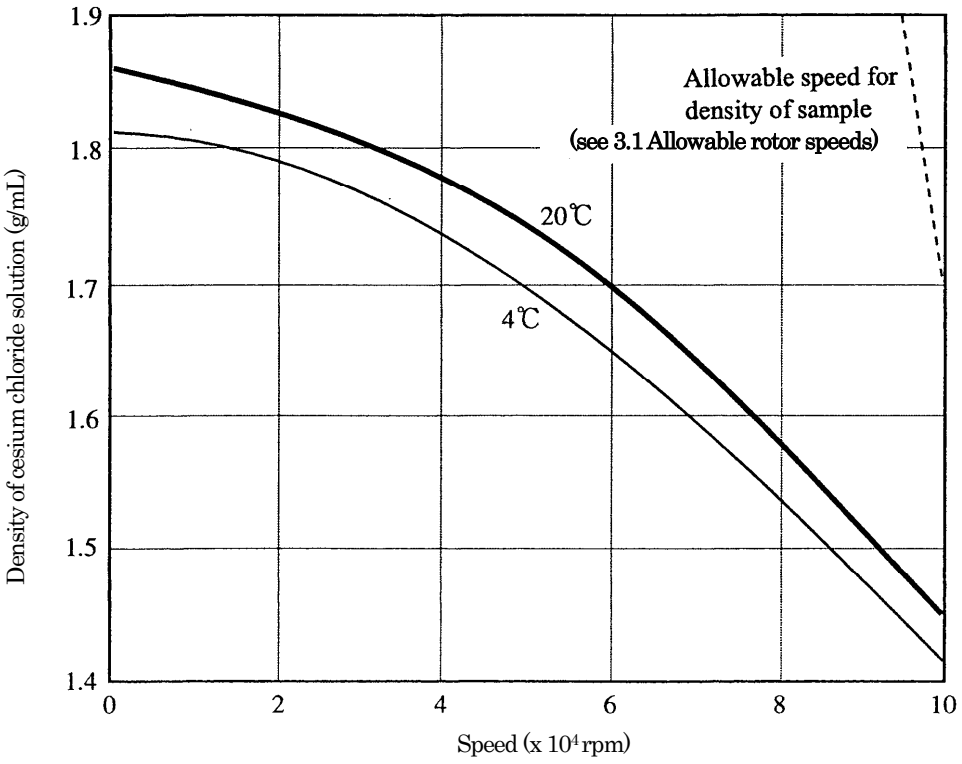
●S110AT Angle rotor



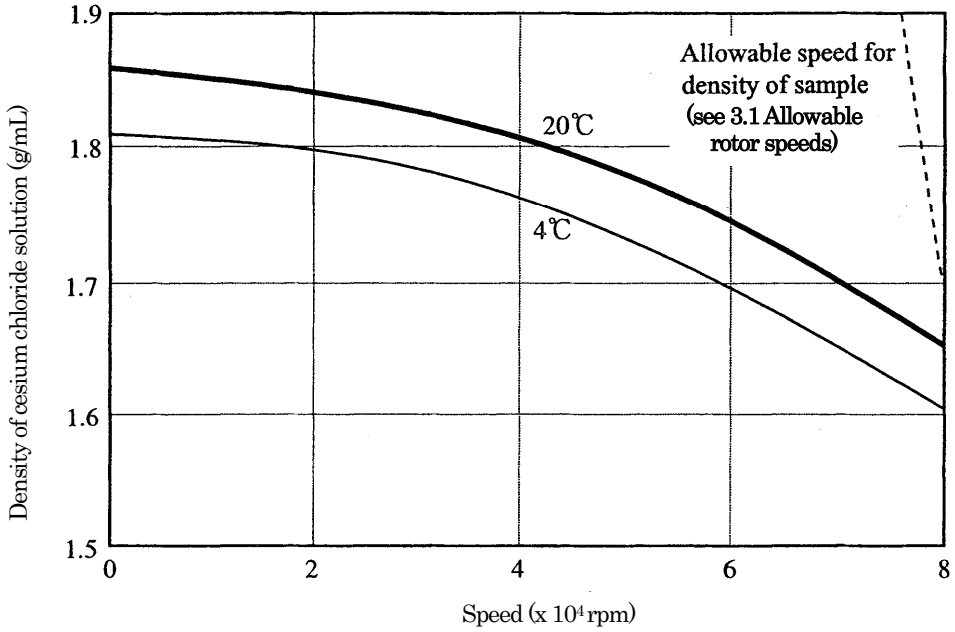
●S100AT3 Angle rotor



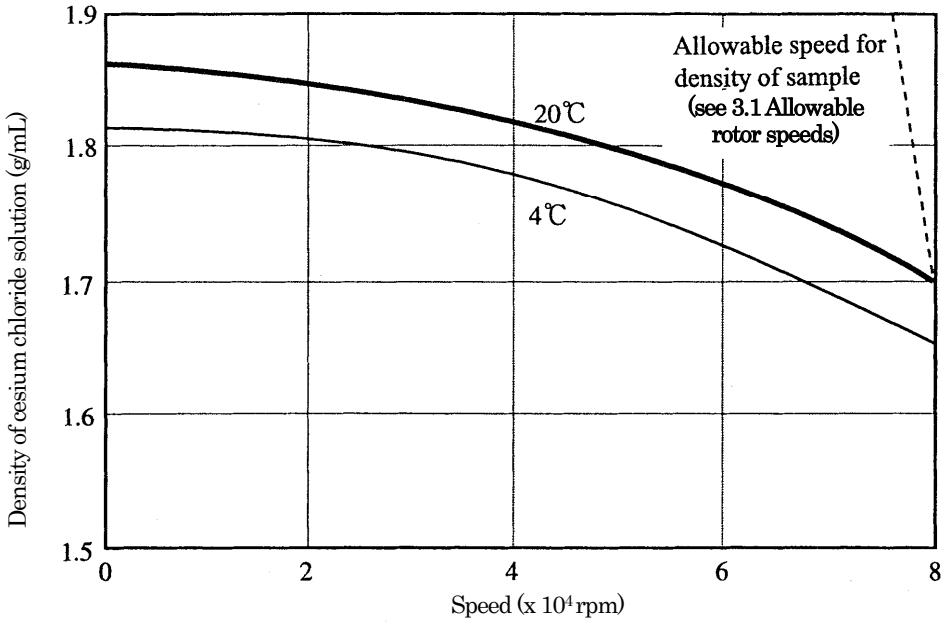
●S100AT4 Angle rotor



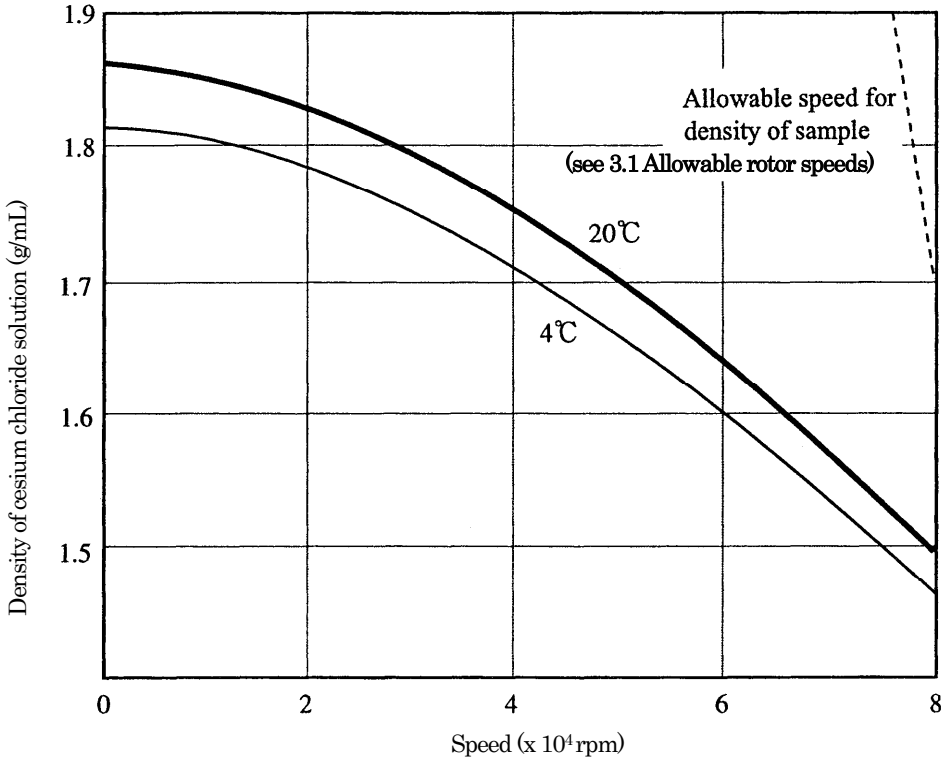
●S80AT2 Angle rotor (Outside)



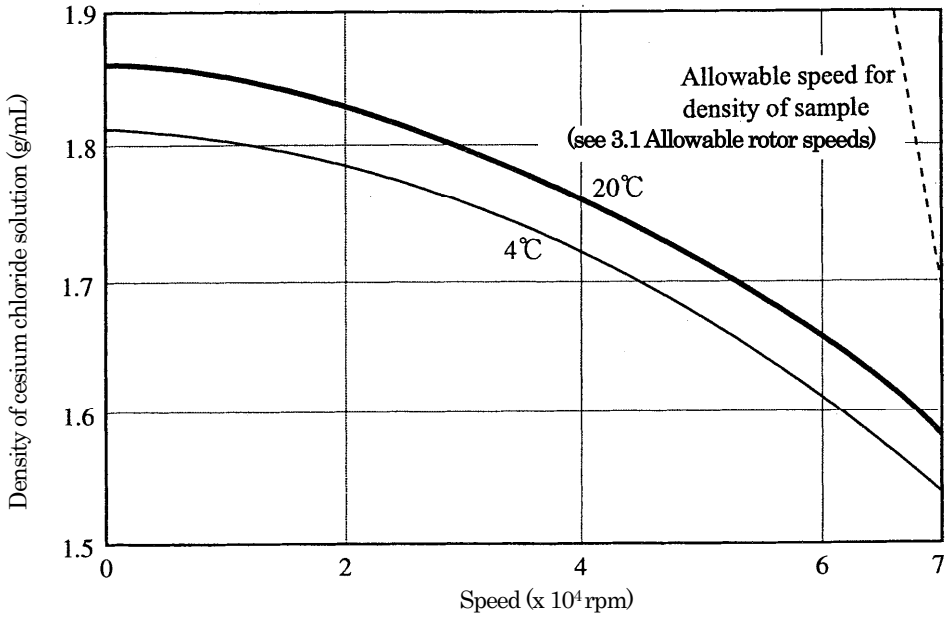
●S80AT2 Angle rotor (Inside)



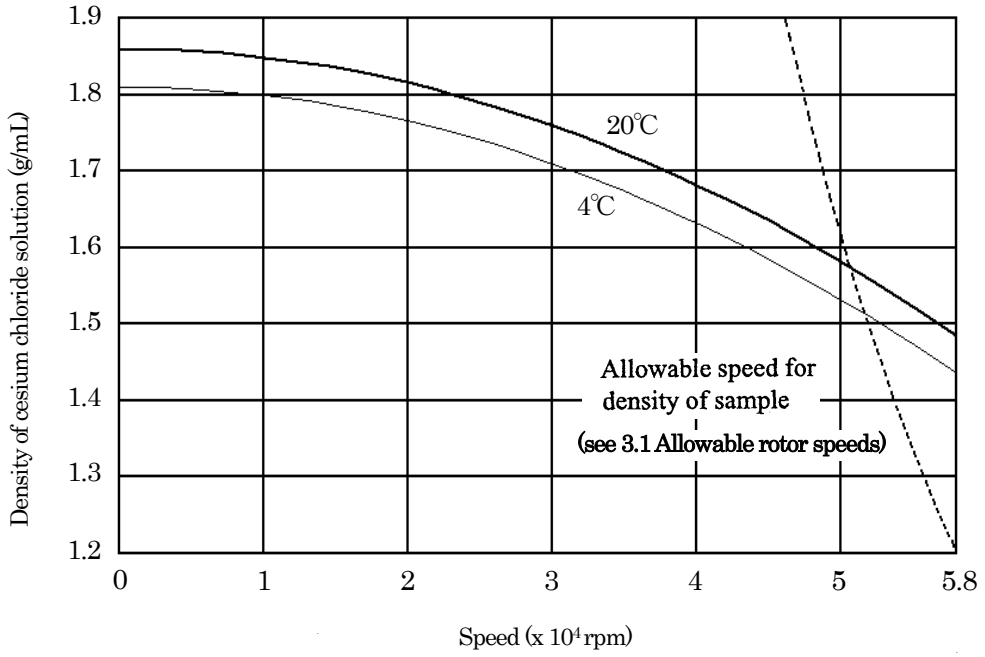
●S80AT3 Angle rotor



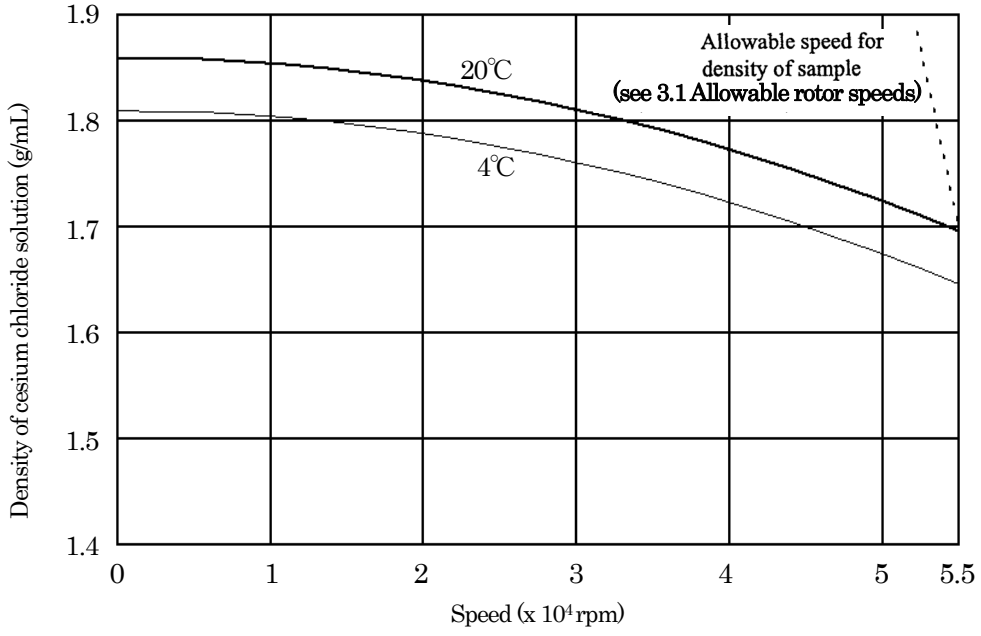
●S70AT Angle rotor



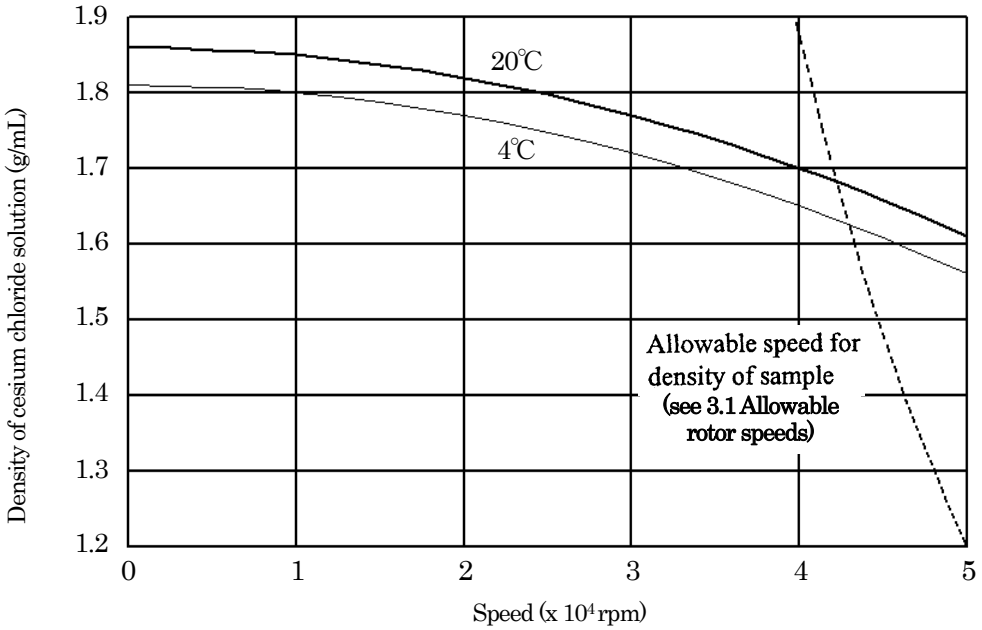
●S58A Angle rotor



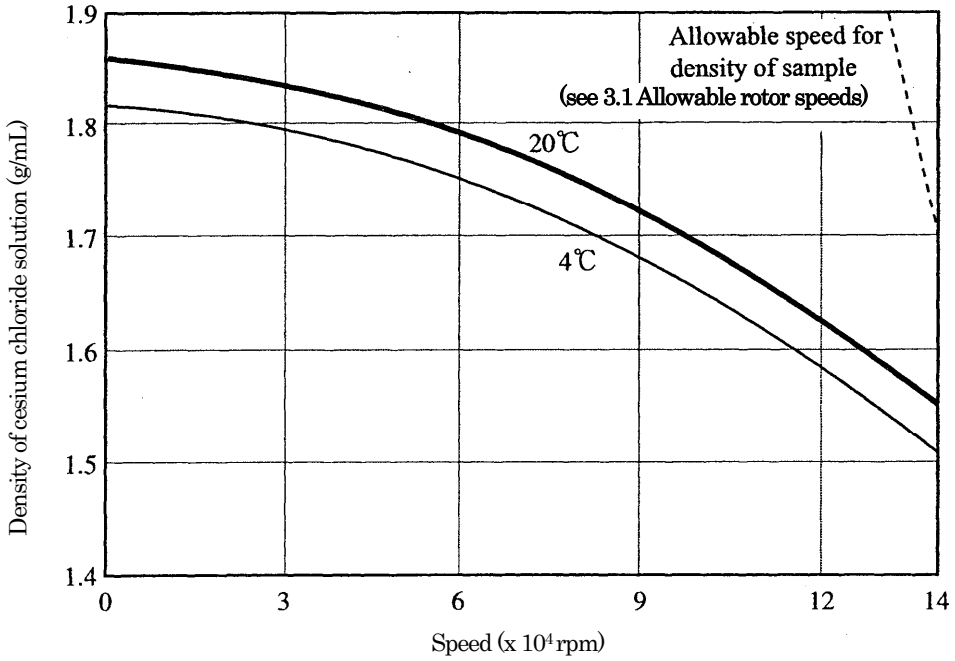
●S55A2 Angle rotor



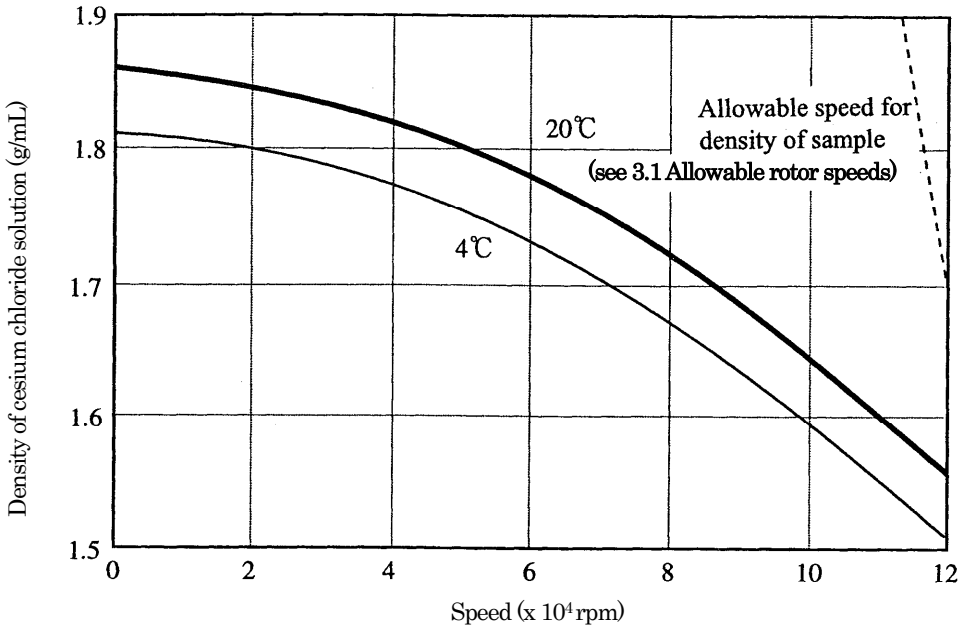
●S50A Angle rotor



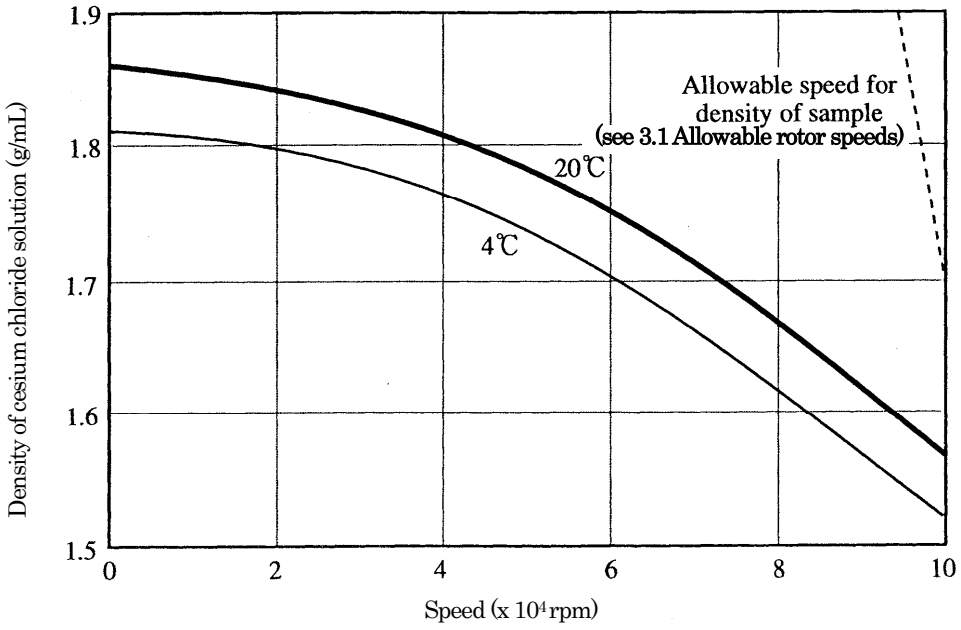
●S140NT Neo-angle rotor



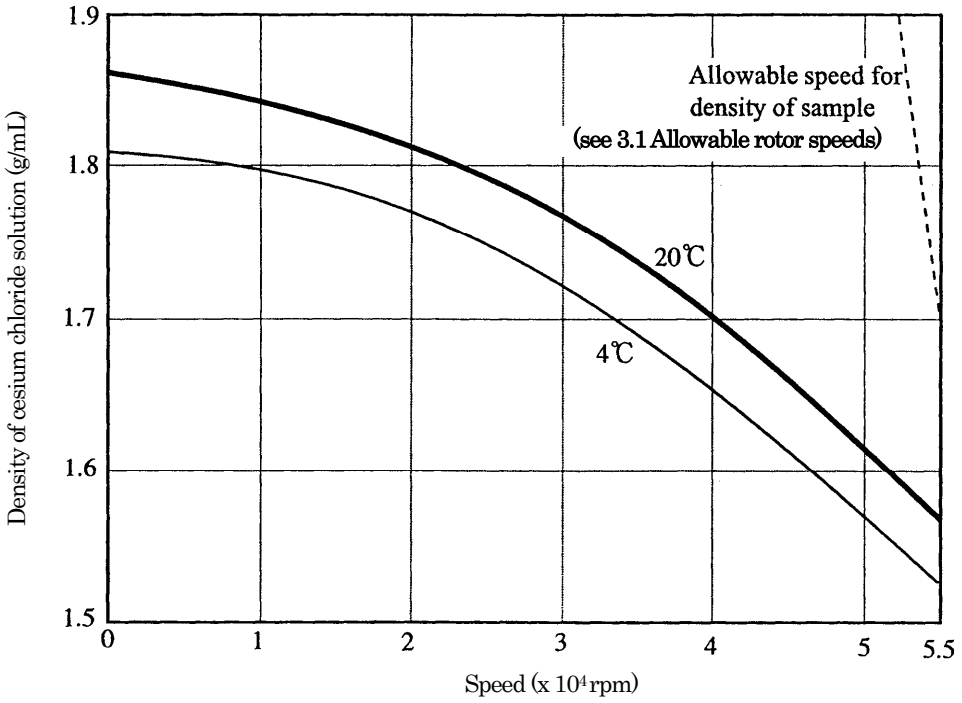
●S120NT Neo-angle rotor



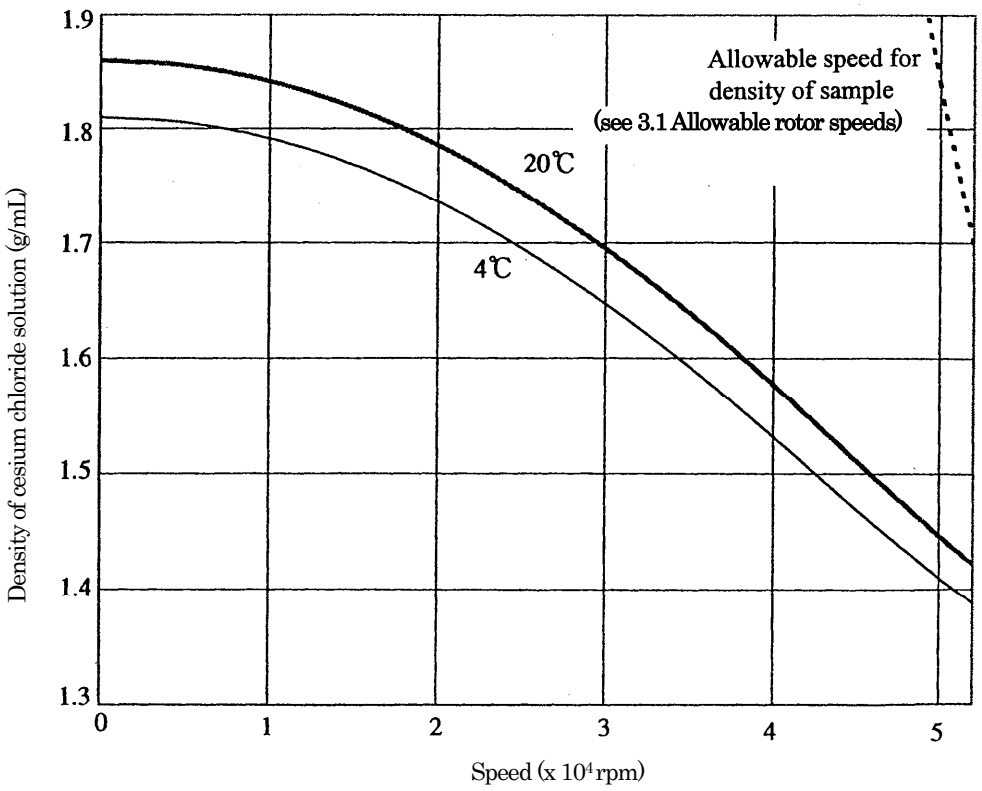
●S100NT Neo-angle rotor



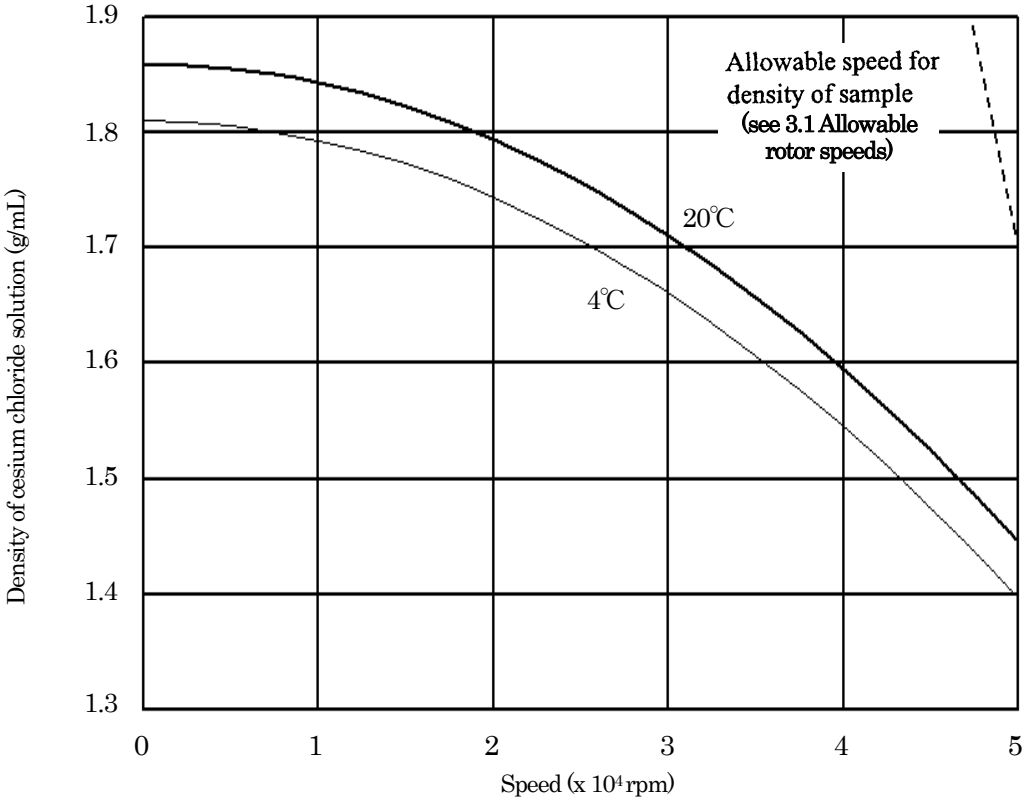
●S55S Swing rotor



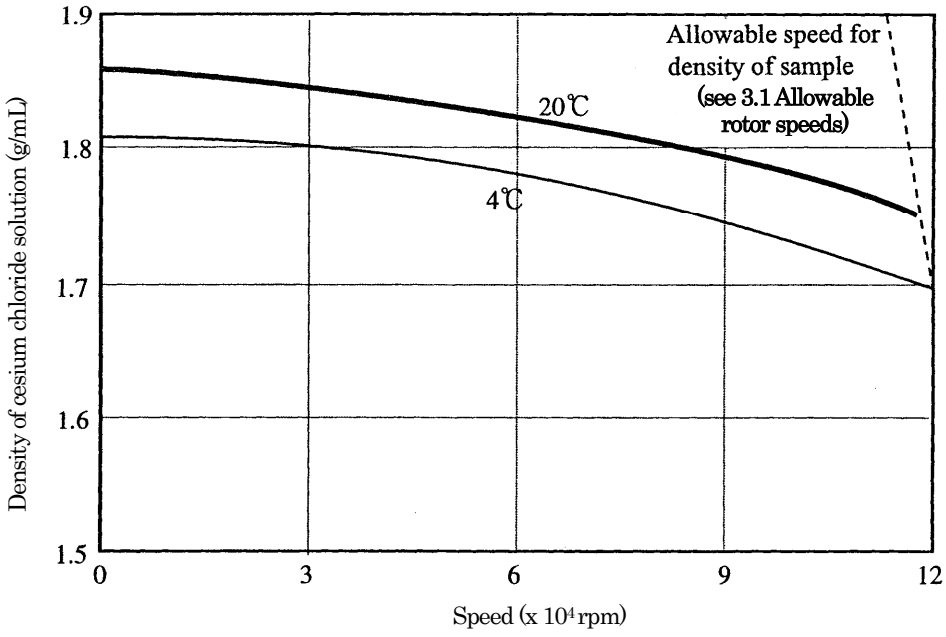
●S52ST Swing rotor



●S50ST Swing rotor



●S120VT Vertical rotor



MEMO

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