

# Thermo Scientific Micro-Ultracentrifuge Rotors

## Instruction Manual

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## Preface

This manual is a guide to the use of the Thermo Scientific Automatic Securing Fixed-Angle, Vertical, and Swinging Bucket Micro-Ultracentrifuge Rotors.

Information herein has been verified and is believed adequate for the intended use of the centrifuge. Because failure to follow the recommendations set forth in this manual could produce personal injury or property damage, always follow the recommendations set forth herein. Thermo Fisher Scientific does not guarantee results and assumes no obligation for the performance of products that are not used in accordance with the instructions provided. This publication is not a license to operate under, nor a recommendation to infringe upon, any process patents.

Publications prior to the Issue Date of this manual may contain information in apparent conflict with that provided herein. Please consider all data in this manual to be the most current.

### **Note, CAUTION, and WARNING**

within the text of this manual are used to emphasize important and critical instructions.



**WARNING** informs the operator of a hazard or an unsafe practice that could result in personal injury, affect the operator's health, or contaminate the environment.



**CAUTION** informs the operator of an unsafe practice that could result in damage of equipment.

**Note** highlights essential information.

CAUTION and WARNING are accompanied by a hazard symbol and appear in the left sidebar near the information they correspond to.

## Important Safety Information

Certain potentially dangerous conditions are inherent to the use of all centrifuge rotors. To ensure safe operation of these rotors, anyone using it should be aware of all safe practices and take all precautions described below and throughout this manual.

### WARNING

- When using radioactive, toxic, or pathogenic materials, be aware of all characteristics of the materials and the hazards associated with them in the event leakage occurs during centrifugation.
- If leakage does occur, neither the centrifuge nor the rotor can protect you from particles dispersed in the air. To protect yourself, we recommend additional precautions be taken to prevent exposure to these materials, for example, use of controlled ventilation or isolation areas.
- Always be aware of the possibility of contamination when using radioactive, toxic, or pathogenic materials.
- Take all necessary precautions and use appropriate decontamination procedures if exposure occurs.
- The use of sealed rotors, buckets, and/or sample containers will offer increased protection from contamination during routine operation. However, these items will not guarantee protection from accidents resulting from damage to the rotor or buckets. Do not run hazardous materials in the centrifuge unless placed in a biohazard enclosure and operated using all appropriate safety precautions.
- Never use any materials capable of producing flammable or explosive vapors, or creating extreme exothermic reactions.
- Use Thermo Scientific rotors only. Use of another manufacturer's rotor can cause rotor failure which could result in personal injury or centrifuge damage.
- Never exceed the maximum rated speed of the installed rotor or bottle/tube; to do so can cause rotor failure.
- Always reduce (derate) rotor speed as instructed in this manual whenever:
  - the rotor speed/temperature combination exceeds the solubility of the gradient material and causes it to precipitate.
  - the compartment load exceeds the maximum allowable compartment load specified. See Chapter 4, “[Special operating conditions](#)”.
  - the bottle/tube has a maximum allowable speed/force that is less than the maximum of the rotor. Failure to reduce rotor speed under these conditions can cause rotor failure.
- Centrifuges routinely deal with high energy levels and could move suddenly in the unlikely event of rotor failure. During centrifuge operation, never lean on or move the centrifuge, keep the surrounding area clear of objects (including all hazardous materials), and do not work on top of or next to the centrifuge.
- Do not attempt to open the chamber door when the rotor is spinning; never override or otherwise disable any of the safety systems of the centrifuge.



### 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.
- Do not operate the centrifuge with a rotor out of balance. To do so can cause damage to the centrifuge drive assembly.
- When using a swinging bucket rotor, be sure to use all the buckets of the same type whether or not there are samples in the 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.
- Do not run or precool/preheat a rotor at the critical speed, as this will have a detrimental effect on centrifuge component life.
- Do not operate centrifuge without a rotor properly installed and locked to the drive, and the rotor cover (if any) must be properly installed.
- Always maintain the rotor in the recommended manner. The rotor and all accessories must be clean and inspected prior to each run. Do not use rotors that show signs of corrosion or cracking.
- Locate the centrifuge on a level floor to avoid rotor imbalance during operation.
- The centrifuge can be damaged if connected to the wrong voltage. Check the voltage before plugging the centrifuge into a power source. Thermo Scientific is not responsible for incorrect installation.
- Always maintain the centrifuge in the recommended manner. See Chapter 6, “Rotor Care and Maintenance”.





## Description

This manual contains information required to operate and maintain the Thermo Scientific Automatic Securing Micro-Ultracentrifuge Fixed-Angle Rotors (S150-AT, S140-AT, S120-AT2, S120-AT3, S110-AT, S100-AT3, S100-AT4, S80-AT2, S80-AT3, S70-AT, S58A, F55-12x1.5 MUC, S55-A2, S50A ) Swinging Bucket Rotors (S55-S, S52-ST, and S50-ST), and Vertical Rotor (S120-VT). If you require additional information regarding operation or maintenance, please contact Thermo Scientific for assistance. In the United States, call Thermo Scientific toll-free 1-866-9-THERMO. Outside the United States, contact the nearest Thermo Scientific office (see back cover) or your local representative for Thermo Scientific products. Thermo Scientific product information is available on our internet web site at [www.thermo.com](http://www.thermo.com)

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## Description

The Thermo Scientific Automatic Securing Micro-Ultracentrifuge Fixed-Angle, Swinging Bucket and Vertical Rotors are designed for use in the Sorvall Discovery M150, Discovery M120, Discovery M150 SE, and Discovery M120 SE, Sorvall MX Plus, and MTX Micro-Ultracentrifuges. The Automatic Securing Micro-Ultracentrifuge rotors are used for small volume sample centrifugation of lipoproteins, viral particles, nanoparticles, plasmid DNA, and many other density gradient separations and differential centrifugation.

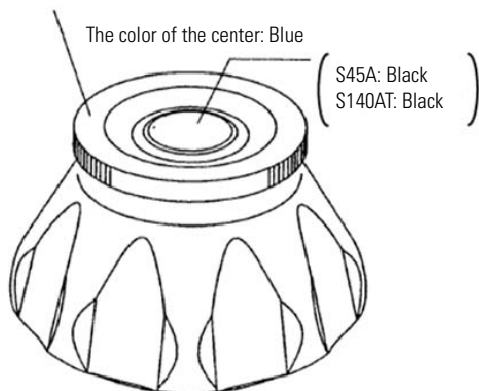
## Rotors

Rotors can be classified as fixed-angle, swinging bucket or vertical rotors by their shape. The automatic securing rotors are the quick setting type and the rotor does not need to be fixed to the centrifuge (see Figure 1-1). It is possible to use only by putting the rotor on the drive spindle of the centrifuge



**CAUTION** Use only rotors approved for the centrifuge. Using a wrong combination can cause damage for the centrifuge and/or the rotor.

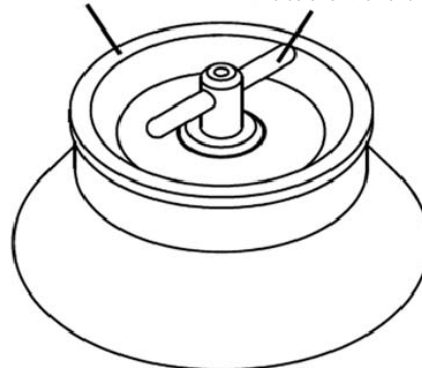
The color of the cover: Black



(a) Type 1, Self-locking rotor

The color of the cover: Black

The color of the handle: Black



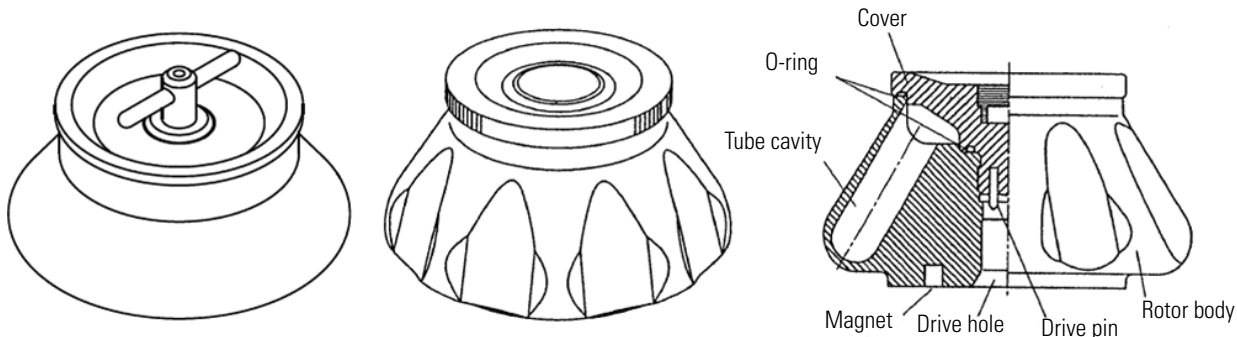
(b) Type 2, Self-locking rotor (S58-A, S55-A2)

**Figure 1-1** Self-locking fixed angle rotors for the micro-ultracentrifuge

## Fixed-angle rotors

Fixed-angle rotors 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 to separate nucleic

acids by isopycnic centrifugation. Fig. 1-2 shows the appearance and part names of fixed angle rotor, and Table 1 shows the specifications of these rotors.



**Figure 1-2** Appearance and part names of self-locking fixed angle rotors

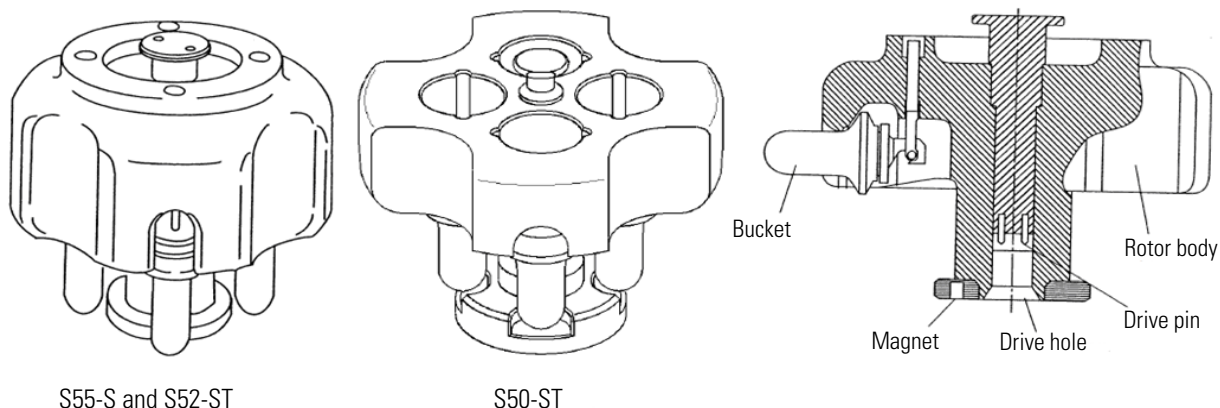
Rotor	Maximum speed (rpm)	Maximum R.C.F (× g)	K-Factor	Tube* (number×ml)	Rotor capacity* (ml)	Weight (kg)	Rotor body material	Cover material
F55-12x1.5 MUC	55,000	221,575	45	12 × 1.5	18.0	1.8	Carbon fiber	Aluminum alloy
S150-AT	150,000	899,744	6.1	8 × 2.0	16.0	0.4	Titanium alloy	Aluminum alloy
S140-AT	140,000	1,048,684	5.0	10 × 2.0	20.0	0.8		Titanium alloy
S120-AT3	120,000	649,826	7.8	14 × 0.5	7.0	0.6		Aluminum alloy
S120-AT2	120,000	649,826	7.8	10 × 2.0	20.0	0.5		
S110-AT	110,000	690,652	15.0	8 × 5.0	40.0	1.2		
S100-AT4	100,000	540,628	16.0	6 × 3.5	21.0	1.1		
S100-AT3	100,000	435,630	7.0	20 × 0.23	4.6	0.5		
S80-AT2	80,000	357,440	14.0	30 × 0.5	15.0	1.0		
S80-AT3	80,000	414,630	23.0	8 × 8.3	66.4	1.5		
S70-AT	70,000	307,052	31.0	20 × 0.5	10.0	1.4		
S58-A	58,000	288,958	50.0	8 × 13.5	108.0	1.9	Aluminum alloy	
S55-A2	55,000	201,046	40.0	12 × 1.5	18.0	0.8		
S50-A	50,000	209,438	61.0	6 × 30.0	180.0	1.8		

\*Indicates nominal capacity

**Table 1-1** Specifications of fixed-angle rotors

## Swinging bucket rotors

Swinging bucket rotors hold 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. 1-3 shows the appearance and part names of the swinging bucket rotor, and Table 2 shows swinging bucket rotor specifications.



**Figure 1-3** Appearance and part names of self-locking swinging bucket rotor

Rotor	Maximum speed (rpm)	Maximum R.C.F. (× g)	K-Factor	Tube* (number × ml)	Rotor capacity (ml)	Weight (kg)	Rotor body material	Bucket material
S55-S	55,000	258,826	44	4 × 2.2	8.8	1.2	Aluminum alloy	Titanium alloy
S52-ST	52,000	275,458	79	4 × 5.0	20	1.7	Titanium alloy	
S50-ST	50,000	252,721	77	4 × 7.0	28	1.8	Titanium alloy	

\*Indicates nominal capacity

**Table 1-2** Specifications of swinging bucket rotors

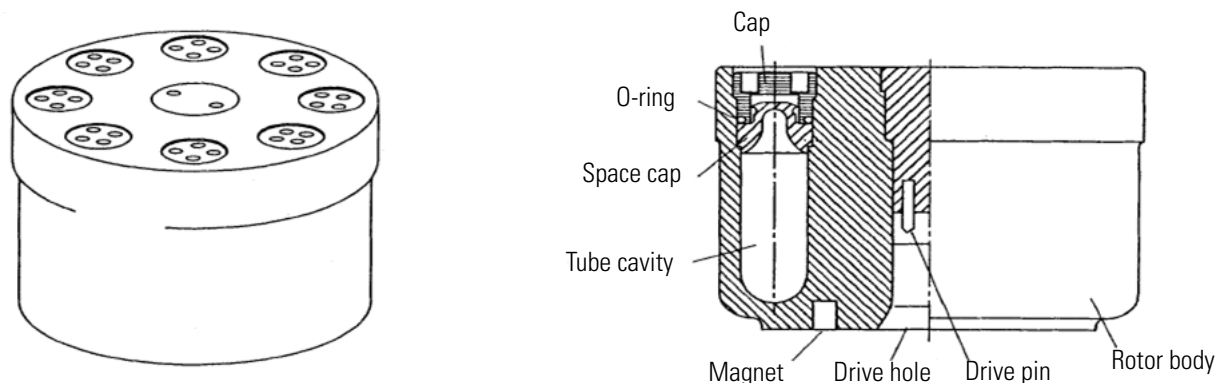


**CAUTION** The S50-ST and S52-ST swinging bucket rotors can only be used with the Thermo Scientific Sorvall MTX, MX Series, and Discovery Series Micro-ultracentrifuges.

The ring-shaped projection at the bottom of the S50-ST and S52-ST swinging bucket rotor is not a rotor stand. It ensures the safety of the rotor and the centrifuge. Be careful not to damage or deform it when handling the rotor.

## Vertical rotors

Vertical rotors hold the tubes perpendicularly to the centrifugal force. It provides a shorter separation time with this rotor type than with swinging bucket and fixed-angle rotors. It is often used to separate nucleic acid by isopycnic centrifugation. Fig. 1-4 shows the appearance and part names of vertical rotor, and Table 3 shows the specifications of the vertical rotor.



**Figure 1-4** Appearance and part names of the self-locking vertical rotor

Rotor	Maximum speed (rpm)	Maximum R.C.F. (× g)	K-Factor	Tube* (number × ml)	Rotor Capacity* (ml)	Weight (kg)	Rotor body material	Cap material
S120-VT	120,000	500,237	7.9	8 × 2.0	16	0.6	Titanium alloy	Aluminum alloy

\*Indicates nominal capacity

**Table 1-3** Specifications of vertical rotors

## Parts and Accessories

To order any of these rotors, specify the correct catalog number as follows using Table 1-4. Tables 5-9 will respectively list the accessories supplied with fixed-angle rotors, tubes supplied with fixed-angle rotors, o-rings supplied with fixed-angle rotors, accessories supplied with the S55-S swinging bucket rotor, and accessories supplied with the S52-ST swinging bucket rotor.

<b>Rotor</b>	<b>Catalog No.</b>
F55-12x1.5 MUC	096-127033
S150-AT	45582
S140-AT	45978
S120-AT3	45584
S120-AT2	45583
S110-AT	45539
S100-AT4	45586
S100-AT3	45585
S80-AT2	45589
S80-AT3	45590
S70-AT	45591
S58-A	45866
S55-A2	45865
S50-A	45540
S55-S	45594
S52-ST	45977
S50-ST	45541
S120-VT	45593

**Table 1-4** Catalog Numbers for Self-locking Micro-ultracentrifuge Rotors

<b>Quantity</b>	<b>Catalog No.</b>	<b>Description</b>
1		Tool Box Kit containing
1	45266	Rotor Holding Fixture
1	65937	Vacuum Grease
1	61556	Lubricant
1	S203944/45173	Cover Opener
1	45272	Tweezers
1	45735	Instruction Manual

**Table 1-5** Accessories supplied with fixed-angle rotors

<b>Rotor</b>	<b>Quantity</b>	<b>Catalog No.</b>	<b>Description</b>
F55-12x1.5 MUC	1 (100/box)	314352H01	1.5ml PA Microtubes
S150-AT	1 (100/box)	45237	1.0 PC Tube
S140-AT	1 (100/box)	45237	1.0 PC Tube
S120-AT3	1 (100/box)	45235	0.5 PC Tube
S120-AT2	1 (100/box)	45237	1.0 PC Tube
S110-AT	1 (100/box)	45239	4.0 PC Tube
S100-AT4	2 (50/box)	45238	3.0 PC Tube
S100-AT3	1 (100/box)	45233	0.23 PC Tube
S80-AT2	1 (100/box)	45235	0.5 PC Tube
S80-AT3	2 (50/box)	45595	6.0 PC Tube
S70-AT	1 (100/box)	45243	0.5 PC Tube
S58-A	1 (100/box)	03237	10 PC Tube
S55-A2	1 (100/box)	314352H01	1.5ml PA Microtubes
S50-A	1 (10/box)	S309140A	25 PC Tube

**Table 1-6** Tubes supplied with fixed-angle rotors

<b>Rotor</b>	<b>Large Rotor Cover O-ring*</b>	<b>Small Rotor Cover O-ring*</b>
F55-12x1.5 MUC	021-127033 (O-ring refresher kit)	
S150-AT	45702	45294
S140-AT	45986	-
S120-AT3	45532	45294
S120-AT2	45532	45294
S110-AT	45703	45294
S100-AT4	45296	45294
S100-AT3	45322	45276
S80-AT2	45450	45294
S80-AT3	45704	45494
S70-AT	45297	45294
S58-A	45451	45294
S55-A2	45451	8062285
S50-A	8062014	45294

\*Two of each style cover O-ring is supplied with each rotor

**Table 1-7** O-rings supplied with fixed-angle rotors

Quantity	Catalog No.	Description
2(50/box)	45240	2.2 PA Tube
8	45276	Bucket O-ring
1	45277	Cap Spanner
1	45312	Bucket Stand
4	45358	Buckets
1	45275	Rotor Stand
1	65937	Vacuum Grease
1	61556	Lubricant
1	45735	Instruction Manual

**Table 1-8** Accessories and tubes supplied with the S55-S swinging-bucket rotor

Quantity	Catalog No.	Description
2 (50/box)	03127	5.0 PA Tube
8	45294	Bucket O-ring
1	45277	Cap Spanner
1	45312	Bucket Stand
1	45272	Tweezers
4	45358	Buckets
1	45275	Rotor Stand
1	65937	Vacuum Grease
1	61556	Lubricant
1	45735	Instruction Manual

**Table 1-9** Accessories and tubes supplied with the S52-ST swinging-bucket rotor

To order other replacement parts and accessories, telephone toll free 1-800-522-7746 in the United States. Outside the United States, contact your local distributor or agent for Thermo Scientific products. For a complete list of available tubes for these rotors, including Re-Seal™ and Easy-Seal™ tubes, see the Thermo Scientific Product Guide. To order or for information, in the United States, call Thermo Scientific toll-free 1-866-9-THERMO; outside the United States, contact the nearest Thermo Scientific office (see back cover) or your local representative for Thermo Scientific products. Thermo Scientific product information is available on our internet web site at <http://www.thermo.com> or <http://www.thermo.de>.

The chemical compatibility of rotor elements and accessory materials is given in the Appendix. This data is to be used only as a guide when selecting a tube or bottle suited for the sample being used.



## Tubes, Caps, and Adapters for Micro-ultracentrifuge Rotors

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# Types of Tubes, Caps, and Adapters



**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

See Figure 2-1 for appearance

### Thin-walled tubes

Thin-walled tubes are used in swinging bucket 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 or S58A rotor. When using the S50A or S58A rotor, you must fill up these tubes (thin walled tubes) with the sample.

### Thick-walled tubes

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

### Re-seal™ tubes and Cone-top™ tubes (Registered trademark of Seton Scientific Company, U.S.A.)

Re-seal and Cone-top tubes are sealed by screwing a plug into the tube and used in fixed-angle and vertical rotor with a plug and a crown. These tubes must be filled up with the sample. Specified tube vise and tightening tools are necessary to seal these tubes.

### Microcentrifuge tubes

The microtube is the tube with the cap and conical shape. 1.5 mL microtubes made of polypropylene can be used with the S110-AT, S100-AT4 and S80-AT3 rotors with adapters. The S55-A2 and F55-12x1.5 MUC rotor are used without adapters. Microtubes (Part No. 314352H01) are recommended when using microcentrifuge tubes in Thermo Scientific micro-ultracentrifuge rotors. The maximum RCF of this microtube is 201,000 x g.

### Screw cap tubes

The screw cap tube is a tube with a screw cap and conical shape. 1.5 mL screw cap tubes can be used with the S110-AT rotor with adapters. It can be used with the volume less than its net volume but fill up the sample with at least 1.0 mL to prevent tube deformity. Be sure to cap the screw cap tube.

### Oak Ridge Bottle (only for the S50-A or S58-A rotor)

This bottle is used with a screw cap for the S50A or S58A rotor. It can be used with any volume less than the net volume but is recommended to fill at least 50 % with sample.

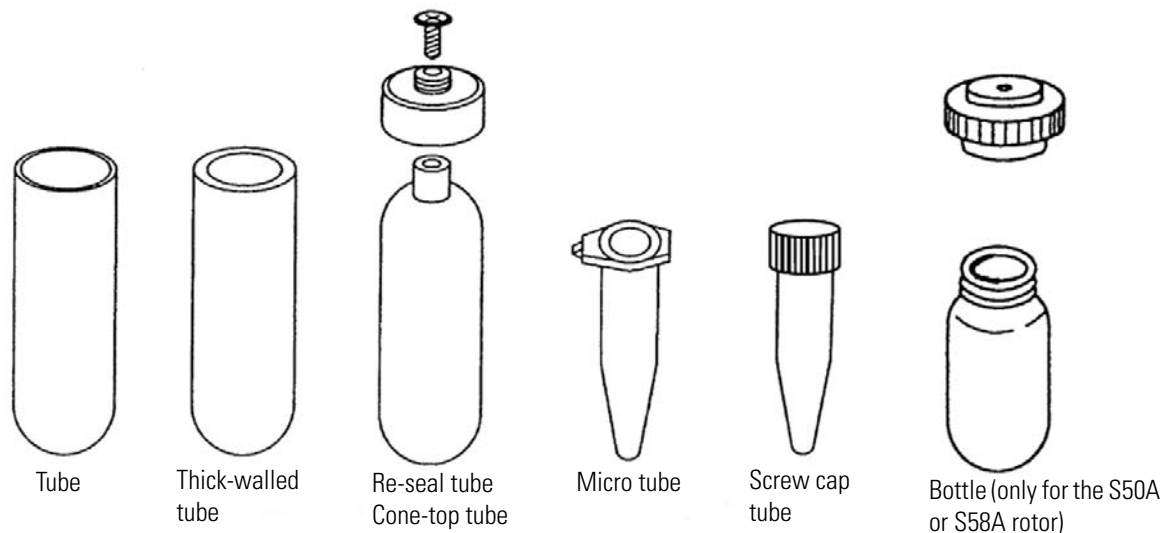


Figure 2-1 Appearance of micro-ultracentrifuge tubes

## Caps and Adapters

### Crowns and plugs (for Re-seal or Cone-top tubes)

Crowns and plugs prevent deformation of Re-seal or Cone-top tubes and leakage from tubes during operation. Crowns are made from aluminum alloy and plugs are made from stainless steel. Be careful that different rotors use different crowns.

### Adapters

Adapters are used when micro tubes are used with the S110-AT, S100-AT4 and S80-AT3 rotor. Adapters are made from white polyacetal.



#### CAUTION

- Adapters are consumables. Replace them with new ones if damage or deterioration (discolored surface, scratches, cracks, deformation, etc.) is found
- Do not operate the rotor with the adapters loaded without the tubes, otherwise the adapters might deform by centrifugation.

## Materials of tubes

See Table 2-1 for an overview of tube materials



### CAUTION

- Run the rotor at the proper temperature (see 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.
- Check the chemical resistance chart and do not use any sample inapplicable to the tubes and bottles. Using such a sample could corrode or deteriorate them.

Material	Abbreviation	Characteristics
Polycarbonate	PC	Strong, transparent, can be autoclaved at 121 °C or less. Use the tubes/bottles at a temperature between 4 °C and 25 °C. Weak in organic solution, alkali solution, and alkali detergent.
Polyethylene terephthalate	PET	Transparent. Can not be autoclaved. Sliceable and puncturable. Weak in organic solution. Use the tubes/bottles at a temperature between 4 °C and 20 °C.
Polypropylene	PP	Strong but susceptible to low temperature (brittle point: 0°C). It can be autoclaved at 121 °C or less. Use the tubes/bottles at a temperature between 4 °C and 25 °C.
Polyallomer (polypropylene copolymer)	PA (PPCO)	Strong and can be autoclaved at 115 °C or less. Use the tubes/bottles at a temperature between 4 °C and 25 °C.

**Table 2-1** Overview of tube materials for micro-ultracentrifuge tubes.

## Washing

Refer to Table 2-2 for washing tubes.

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, do not use a detergent of pH 9 or more. Do not allow the soaking in dilute detergent for a long time because otherwise the tubes would become brittle.
  - For 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. Use neutral determents between pH 5 and 9.

Washing condition	Tubes			Crowns, plugs, caps, and adapters
	PA,PP	PC	PET	
Washing solution (pH5 or less)	U	U	U	U
Washing solution (between pH5 and pH9)	S	S	S	S
Washing solution (pH9 or above)	S	U	S	U
Hot water (50 °C or less)	S	S	S	S
Ultrasonic Washing neutral detergent (pH 7)	S	S	S	S
Drying condition	Drying in the air			

**Table 2-2** Washing conditions for tubes  
S: Satisfactory  
U: Unsatisfactory

## Sterilization

Refer to Table 2-3 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.

## 2 Tubes, Caps, and Adapters for Micro-ultracentrifuge Rotors

### Materials of tubes

Sterilizing condition		Tubes				Adapters	Cone-top tubes or Re-Seal tubes
		PA	PP	PET	PC	Crowns	Plugs
Autoclaving	115 °C(0.7kg/cm <sup>2</sup> ) for 30min.	S	S	U	S	S	S
	121 °C(1.0kg/cm <sup>2</sup> ) for 20min.	U	S	U	S	S	S
	126 °C (1.4kg/cm <sup>2</sup> ) for 15min.	U	U	U	U	U	U
Boiling	15-30min.	S	S	U	S	S	S
UV rays	200-300mm	U	U	U	U	S	S
Gas	Ethylene oxide	S	S	U	U	S	S
	Formaldehyde	S	S	S	S	S	S
Chemical solution	Ethanol (70 %)	S	S	S	U	S	S
	Hydrogen Peroxide (3 %)	S	S	S	S	S	S
	Formalin	S	S	S	S	U	U

**Table 2-3** Sterilizing conditions for tubes

S: Satisfactory

U: Unsatisfactory

## Storage

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

## Inspection

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

## Life

The life of tubes/bottles depends upon the sample, rotor speed, temperature, etc. For standard life of tubes/bottles, refer to table 2-4.

PET tubes, micro tubes, screw cap tubes are disposable.

When the rotor speed is 25,000 rpm or more, a lot of fine stripes may occur on the tube (crazing), but there is often not problems with sample leakage.

<b>Tubes/Bottles</b>		<b>Ordinary condition<sup>*1</sup></b>	<b>Rotor speed is 120,000 rpm or more</b>	<b>Sterilizing condition:</b>	<b>Sample: Weak Alkali<sup>*2</sup></b>
Thin walled tubes	PA, PP	5 times	-	1 time	5 times
	PC	5 times	1 time	1 time	1 time
Thick walled tubes/bottles	PA, PP	5 times	1 time	1 time	5 times
	PC	20 times	1 time	5 times	10 times

\*1: Ordinary condition: Aqueous samples (between pH 5 and pH 9) are used for 24 hours.

\*2: Sample of weak alkali: sample between (pH 7 and pH 9)

## **2 Tubes, Caps, and Adapters for Micro-ultracentrifuge Rotors**



## Run Preparation

Read this chapter before using the rotor. It contains important safety checks that should be done before every run. It also includes information about the rotor that you will need when determining the chemical compatibility of your sample with the rotor.

Rotor Care .....	3-2
Prerun Safety Checks .....	3-2
Rotor Holding Fixture .....	3-2
Chemical Compatibility .....	3-3
Allowable Rotor Speeds .....	3-3
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Using Fixed-Angle Rotors (except the S55-A2 and S45-A) .....	3-4
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## Rotor Care



**WARNING** The stresses that the rotor withstands during centrifugation eventually cause the rotor body to weaken, increasing the possibility of rotor failure. We recommend that the rotor be withdrawn from service after five (5) years of use. Failure to do so can cause rotor failure with subsequent sample loss, damage to the rotor and/or centrifuge, and possible personal injury. If the material being processed is hazardous, take all necessary precautions to prevent exposure should rotor failure occur.



**CAUTION** When using a tube (or bottle) assembly other than those supplied by Thermo Scientific, be sure to check the top speed capability; when in doubt, do a test run for the desired application. If using a Thermo Scientific tube (or bottle) assembly other than those supplied with this rotor, see Rotor and Tube Guide on our internet web site <http://www.thermo.com> or <http://www.thermo.de> for the maximum speed. Exceeding the top speed capability of the tube (or bottle) assembly can result in its breakage. See Chapter 2 for more detail.

## Prerun Safety Checks

1. To ensure safe performance of the rotor, before every run you should read the Safety Information Page in the front of this manual.
2. Make sure each tube compartment is clean and that there is no sign of corrosion or cracking.
3. Make sure the rotor itself is clean and shows no sign of corrosion or cracking. Also, make sure there are no scratches or burrs around the rim of the rotor.
4. Wipe the magnet surface (on the bottom of the rotor) to remove any iron powder accumulation. Inspect the two O-rings in the rotor cover for cracks, tears, or abrasions; replace if necessary.
5. Check the centrifuge chamber and the drive spindle to be sure they are clean and free of scratches and burrs. Check the chemical compatibility of all materials used (see Appendix).
6. Be sure the proper environment has been selected for operation; for example, controlled ventilation or isolation, if required.
7. Check the top speed capability of the tube (or bottle) being used.
8. Make sure the rotor cover is on and properly tightened.

## Rotor Holding Fixture

The rotor holding fixture (Catalog No. 45266) is used to hold the rotor during the rotor loading and unloading procedures to prevent disturbance of the gradient or sample. For the Fiberlite F55-12x1.5 MUC rotor a rotor pad (097-1409) is available.

## Chemical Compatibility

The critical components of each rotor likely to come in contact with solution are: rotor body (titanium\*); rotor cover assembly (aluminum); O-rings (Buna N); and the material of the tubes being used.

The chemical compatibility of rotor elements and accessory materials is given in the Appendix. Because no organized chemical resistance data exists for materials under the stress of centrifugation, this data is intended to be used only as a guide to the selection of tube materials. When in doubt, we recommend pretesting of sample lots. Also use this chemical resistance data when choosing an appropriate cleaning or decontamination method.



**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.

## 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 1.7 g/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 1.2 g/ml). However, the allowable speed may be lower depending on the density of sample or the use of salt such as cesium chloride (CsCl) or the combination of the tubes and caps (see the below.). Do not exceed the allowable speed of the rotor. See Chapter 4 for detailed information on derating the rotor speed.

## Sample Limitations



**WARNING** Never use explosive or flammable samples. This centrifuge and rotor are not explosion-proof. 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.



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

### 3 Run Preparation

Using Fixed-Angle Rotors (except the S55-A2 and S45-A)

## Using Fixed-Angle Rotors (except the S55-A2 and S45-A)

1. Prepare the sample

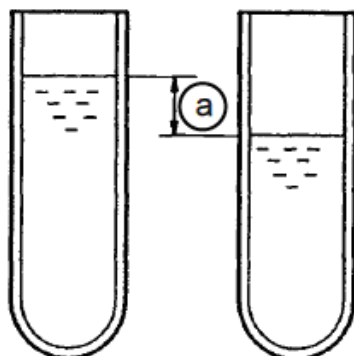
Balance the tubes so that they are symmetrically arranged. The approximate allowable imbalance is shown in Table 3-1.



**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 3.1 and Figure 3.1), the alarm message “IMBALANCE” might appear. Balance tubes more accurately again if alarm message “IMBALANCE” appears.

<b>Rotor</b>	<b>Approximate allowable imbalance level of sample for MTX 150, MX Plus Series, and Discovery Series</b>
F55-12x1.5 MUC	5 mm
S150AT	5 mm
S140AT	3 mm
S120AT2	5 mm
S120AT3	5 mm
S110AT	4 mm
S100AT3	5 mm
S100AT4	5 mm
S80AT2	5 mm
S80AT3	4 mm
S70AT	5 mm
S58A	5 mm
S50A	3 mm

**Table 3-1.** Approximate allowable imbalance



**Figure 3-1** Imbalance in level of sample

## 2. Preparation of rotor

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, S55A2, and S50A rotor deformed?
- Are the threads of the rotor body and the cover worn?

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.

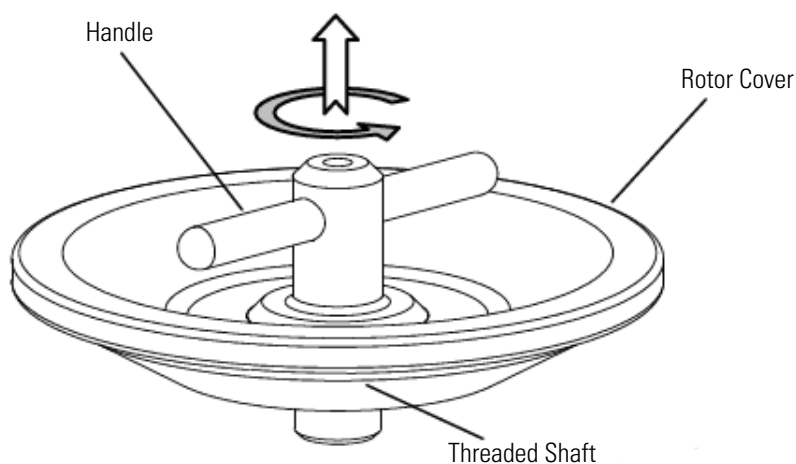
Set rotor to the rotor vise.

Coat the packing lightly with vacuum grease to make completely air-tight, and wipe them clean of excess grease. When using the S58A, S55A2, and S50A rotor, coat the handle sealing (O-ring) lightly with 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. 3-2). After having finished coating a vacuum grease to the handle sealing (O-ring), set the handle with the handle sealing (O-ring) on the rotor body, and then turn the handle to the clockwise to assemble the handle into the rotor cover.

### 3 Run Preparation

Using Fixed-Angle Rotors (except the S55-A2 and S45-A)

Apply a thin coat of aluminum lubricant on threads of the rotor and the cover.



**Figure 3-2** How to remove the handle for the S58-A, S55-A2, and S50-A rotors

#### 3. Setting the tubes

1. Wipe off the moisture around each tube, then load into 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 of the rotor.
2. Place the cover on the rotor and tighten it until the packing (O-ring) is fully compressed.



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



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

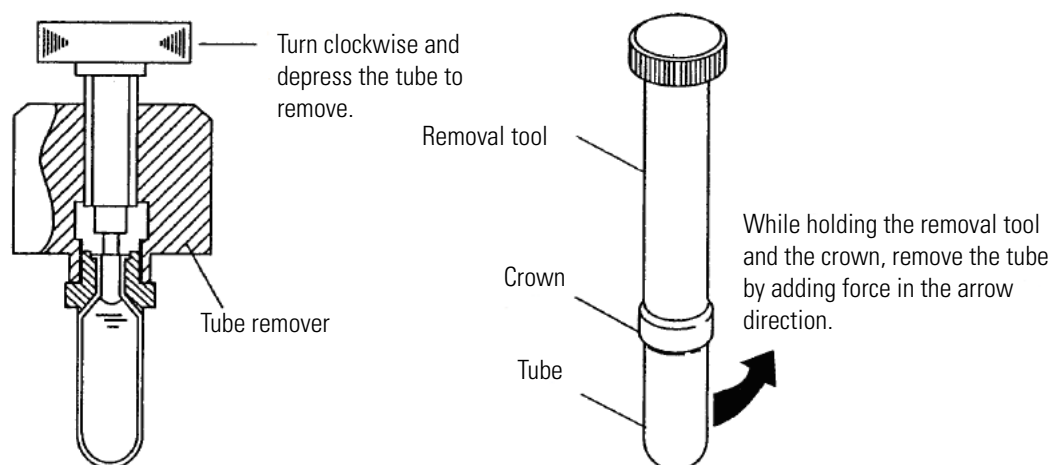
#### 4. Operation

1. Gently and securely set the rotor onto the drive spindle in the ultracentrifuge.
2. For operation refer to the instruction manual of the preparative micro-ultracentrifuge.

#### 5. Removing the sample

1. Upon completion of centrifuge, carefully remove the rotor from the drive spindle.
2. Set the rotor on the rotor vise gently.

3. Remove the cover. If the cover is too tight to be removed, use the rubber sheet (cover opener) provided to prevent slippage for easy removal, or refer to [Using the Cover Opener 3](#) to remove it.
4. Remove tubes with tweezers or the tube setter. In case of Re-seal tubes or Cone-top tubes, remove the tubes from the rotor as follows. Remove tubes from the rotor with the removal tool. Before collecting samples, set the assembly of the tube and the crown to the tube vise. And then remove the plug with the tube setter (C). When removing the crown from the tube after collecting the samples, use the tube remover provided with the tube vise as shown in Fig. 3-3.
5. Recover supernatant or pellets. In case of the seal tubes or Re-seal tubes, the sample recovery stand is convenient when using recovering.
6. Perform maintenance and inspection after use.



**Figure 3-3** Removing Crown from Re-Seal and Cone-top tubes

## Using Microtubes in Fixed-Angle Rotors

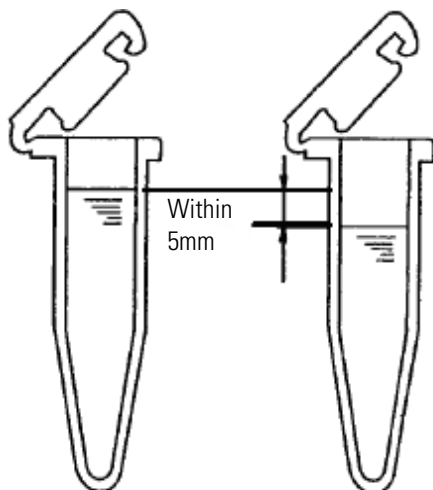
### 1. Preparation of sample

Microtubes (1.5 ml) can be used with the S110-AT, S100-AT4 and S80-AT3 rotor with adapters. The S55-A2 and F55-12x1.5 MUC are used without adapters. We recommend the use of the microtube (Catalog No. 314352H01) when using  $g$ -force up to 221,000  $\times g$ . Other tube brands can be used, but they may not be able to attain high  $g$ -force and speeds. We recommend pretesting the other brands of tubes at the desired run speed, time, and temperature before using them with a sample.

### 3 Run Preparation

Using Fixed-Angle Rotors (except the S55-A2 and S45-A)

Use a pipette or syringe to fill the tubes with samples of equal density, then firmly close the tube lids. The maximum fill volume of each tube is 1.0 ml in the S100-AT4 and 1.3 ml in the S55-A2 and S45-A. Balance samples within 5mm of each other (Figure 3-4).



**Figure 3-4** Difference in level of imbalance using microtubes in the S55A2, S45-A, and S100-AT4 rotors

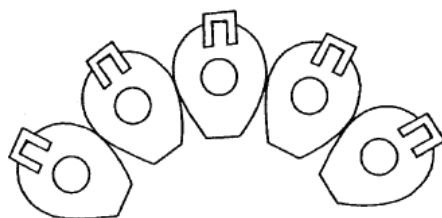
#### 2. Preparation of rotor

Follow previous instructions as outlined above.

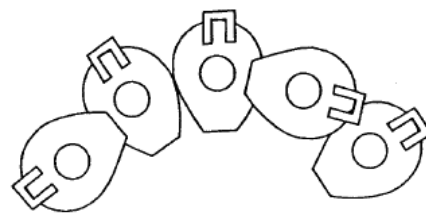
#### 3. Setting tubes

Wipe off the moisture around each tube, then load into the rotor. Arrange the microtubes as demonstrated below (Figure 3-5). 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 of the rotor.

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



(1) CORRECT



(2) WRONG

**Figure 3-5** Correct method of microtube arrangement

**NOTICE** The F55-12x1.5 MUC rotor requires a different loading as explained here. Refer to page 3-15 for further instructions.

#### 4. Operation

Follow the instructions as outlined above.

#### 5. Removing sample

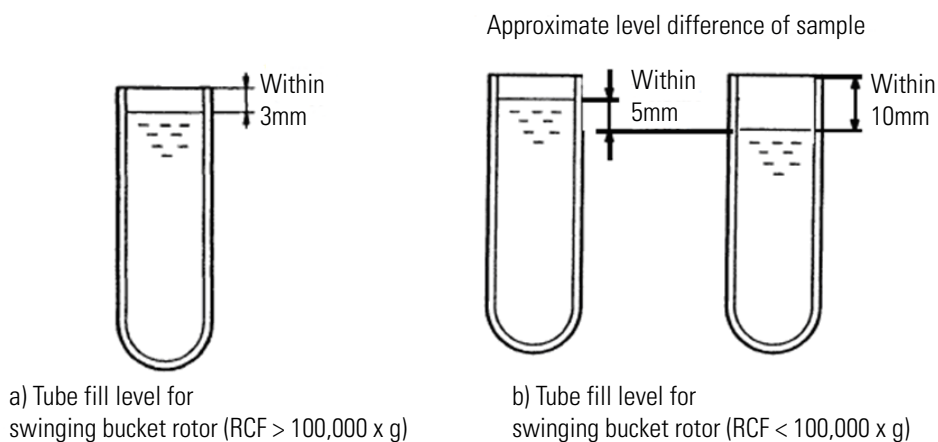
Follow the instructions as outlined above.



## Using Swinging-bucket rotors

### 1. Preparation of tubes

- Fill the tubes with sample of the same density up to a level within 3mm from the top of the tube when tubes are to be used over 100,000 x g. When the tubes are used under 100,000xg, you could use them with a sample level within 10 mm from the top. If the volume of the sample is small, it will be occur buckling of the tubes. (see Figure 3-6)
- Put the tubes in the bucket stand.



**Figure 3-6** Sample fill levels for tubes in swinging bucket rotors



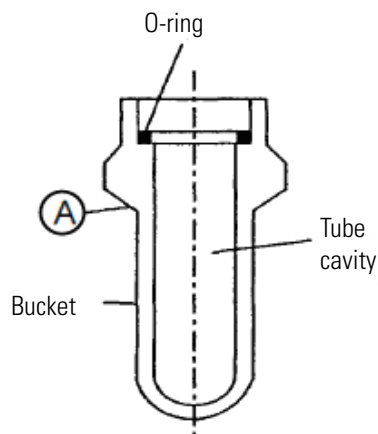
**CAUTION** Extremely different sample quantities must be avoided. Failure to do so might damage mechanical components. Although you balanced the tubes within the approximate allowable imbalance (see above), alarm message “IMBALANCE” might appear. Balance tubes more accurately again if alarm message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

### 2. Preparation of the buckets (Figure 3- 7)

- 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?
- Wipe well the tube cavity of the buckets.
- Set O-ring coated with vacuum grease thinly into the bucket. Worn or damaged O-ring might cause poor vacuum sealing. Replace the O-ring with spare one.
- Apply a thin coat of aluminum lubricant on threads of the bucket caps.
- Put the prepared bucket in the bucket stand.

### 3 Run Preparation

Using Swinging-bucket rotors



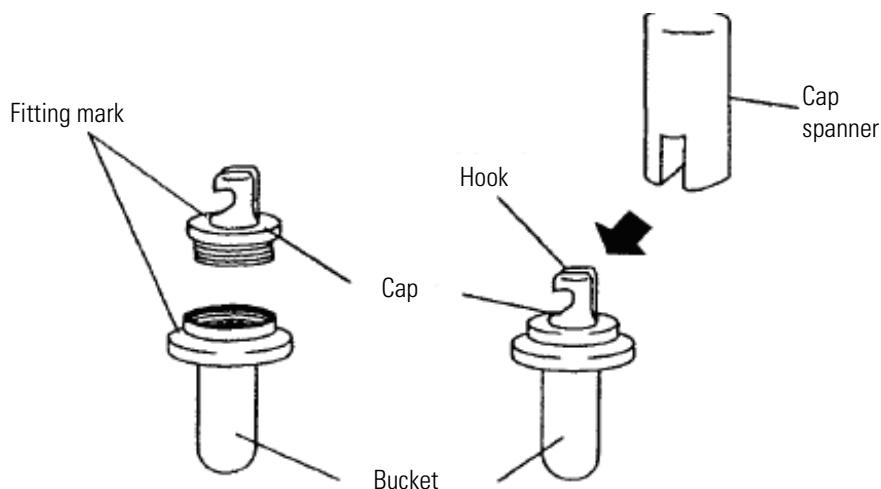
**Figure 3-7** Bucket appearance for Swinging-bucket rotor

#### 3. Setting the tubes

- Wipe off moisture around each tube, then, load the rotor. Place the tubes which are balanced within 0.2g or as described above, in the bucket symmetrically. Serious imbalance can cause damage to the drive spindle of the ultracentrifuge and the drive hole in the rotor.
- 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 S50-ST, the cap spanner is not required (Figure 3-8).



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



**Figure 3-8** Tightening the bucket cap with cap spanner.

4. Installing the buckets

Follow instructions in Figures 3-9 - 3-11 for proper bucket loading techniques.

a. Rotors other than the S50-ST.

Install all of the numbered buckets in the corresponding position of the rotor. Make sure that both hooks properly hang on the pin (Figure 3-8).

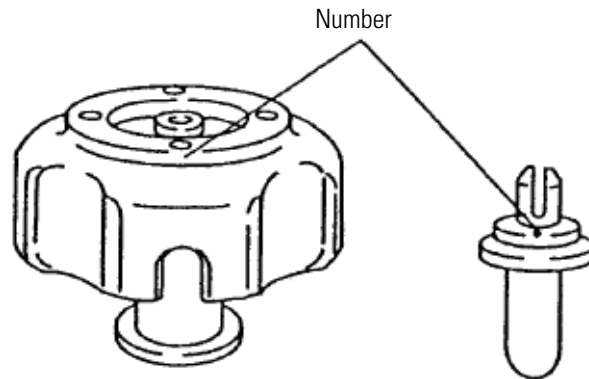


Figure 3-9 Numbered bucket and rotor

b. S50-ST 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 (Figure 3-10).

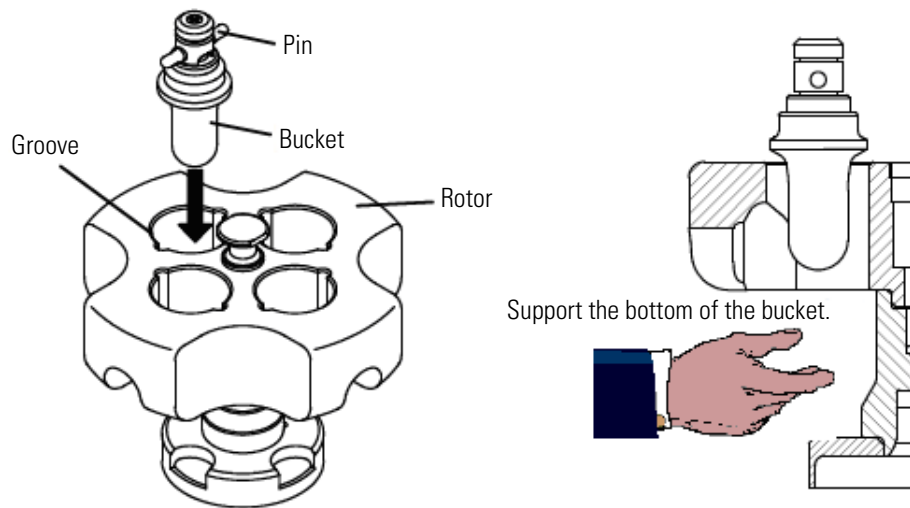
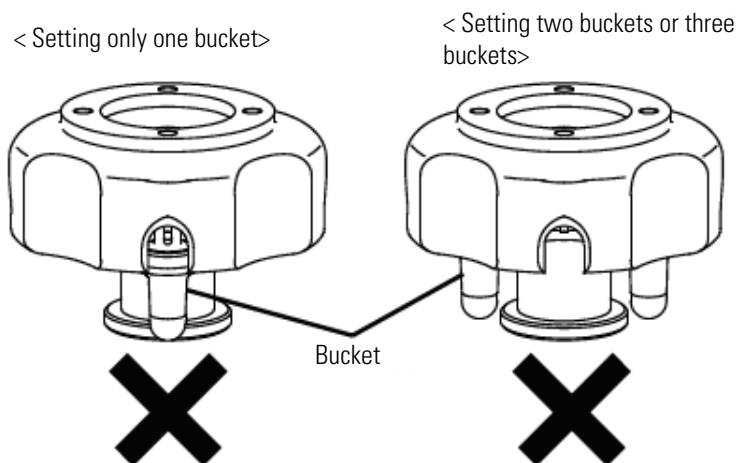


Figure 3-10 Removing/installing buckets



**WARNING** Be sure to set all buckets of the same type whether or not samples are put in buckets (Figure 3-11): 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. All the buckets must be correctly capped.



**Figure 3-11** Examples of incorrect bucket setting.

5. Operation

- a. Gently and securely set the rotor onto the drive spindle in the ultracentrifuge.
- b. For operation refer to the instruction manual of the preparative micro-ultracentrifuge.

6. Removing sample

- a. Upon completion of the centrifuge run, carefully remove the rotor from the drive spindle.
- b. Remove the buckets and stand with them in the bucket stand.
- c. Loosen the cap of the bucket. When removing buckets from the S50-ST rotor, see Figure 3-10.
- d. Take the tubes out with the tweezers.
- e. Recover supernatants or pellets.
- f. Perform maintenance and inspection after use.

## Using Vertical Rotors (S120-VT)

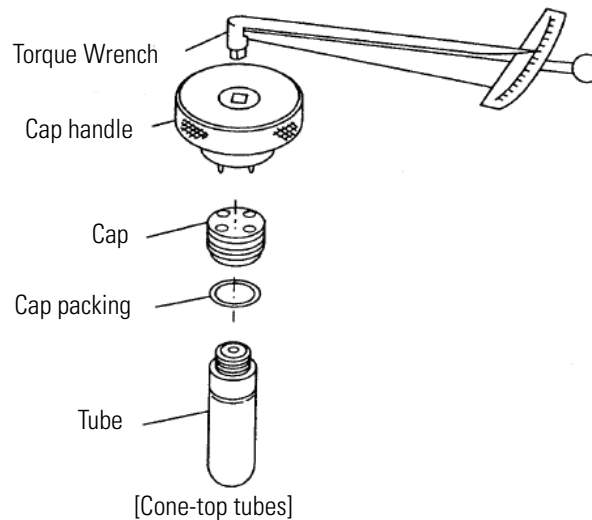
1. Preparation of tubes

- a. Prepare tubes according to manufacturers suggestion or see Chapter 2.

2. Preparation of rotor

- a. 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?

- b. Set rotor to the rotor vise. In case of Cone-top tubes, mount the tube vise to the desk etc. before setting rotor.
  - c. Coat the cap packing lightly with vacuum grease to make completely air-tight, and wipe them clean of excess grease.
  - d. Apply a thin coat of aluminum lubricant on threads of the rotor and the cap.
3. Setting the tubes
- a. 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.
  - b. Place the caps on the tube cavities and tighten it securely with the handle. In case of Cone-top tubes, tighten the caps with the cap handle and torque wrench, and the tightening torque must be 7.845 N/cm (Figure 3-12).



**Figure 3-12** Placing and tightening caps



**CAUTION**

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

4. Operation

- a. Gently and securely set the rotor onto the drive spindle in the ultracentrifuge.
- b. For operation refer to the instruction manual of the preparative micro-ultracentrifuge.

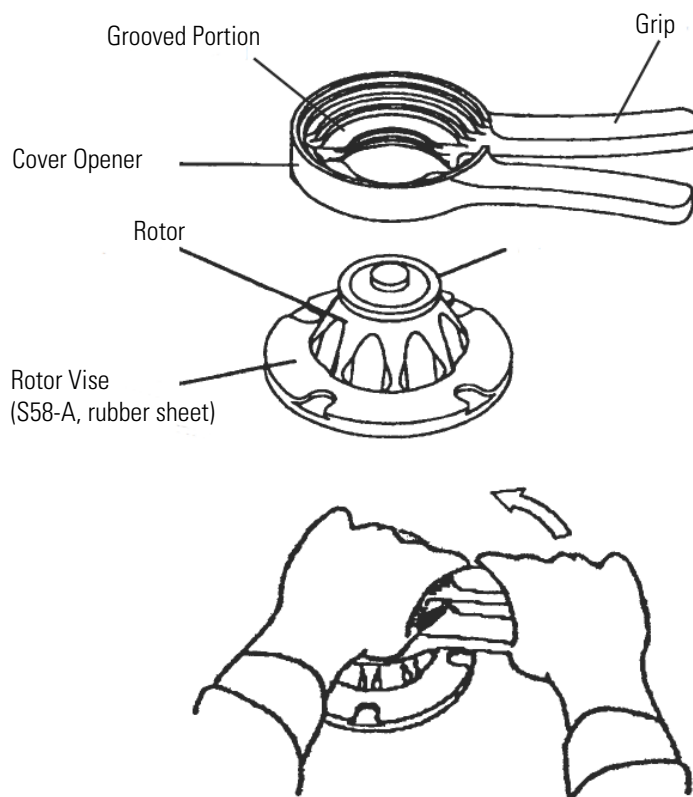
5. Removing sample

- a. Follow instructions outlined in the section for removing sample from fixed angle rotors.

## Using the Cover Opener 3

This cover is used for micro-ultracentrifuge rotors (cannot be used on the S100AT3 Rotor). The cover opener will easily remove the cover if it is difficult to remove after rotor operation. The interior of the cover opener has grooved portions to match each cover.

1. Place the rotor on rotor vise (the S58-A will be placed on a rubber sheet) being careful not to disturb the sample.
2. Place the grooved portion of the cover opener on the outer diameter of the cover.
3. Press down on the cover opener from the top with the other hand and turn the cover opener counterclockwise.
4. Remove the cover.



**Figure 3-13** Using the cover opener

## Using the Fiberlite F55-12x1.5 MUC Rotor

The Fiberlite F55-12x1.5 MUC Rotor is for use in Sorvall MX Plus and MTX Micro-Ultracentrifuges. Follow these instructions to use the Fiberlite F55-12x1.5 MUC Rotor safely and as intended. The Fiberlite F55-12x1.5 MUC rotor requires different handling than the generic instructions for the other micro-ultracentrifuge rotors to prevent tube leakage.

Centrifuges built since 2022 starting with serial number 921380 for MTX and 921412 for MX+ can use the F55-12x1.5 MUC rotor. To select the rotor from the user interface of older centrifuges a software update is needed. Contact the Thermo Fisher Scientific service for an update.

### Load the rotor



**CAUTION** Loss of sample can occur

Due to incorrect installed tubes loss of sample can occur. Make sure to only use the 1.5 mL microtubes (314352H01). Insert the microtubes properly and close the rotor lid. Do not pour the test fluids directly to the rotor cavities.

### Fill level



The 1.5 mL microtubes can be used both in full volume as well as partial fill volume. Minimum fill volume is 0.2 mL.

### Tube positioning

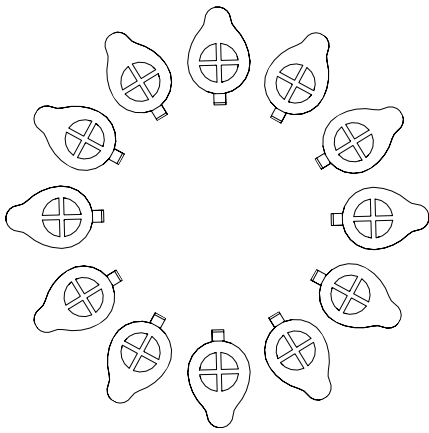
Make sure the tube cap hinge points inwards to the rotor center and the tube cap grip points outwards. The 1.5 mL tubes fit in the rotor cavities and will fixate if properly positioned.



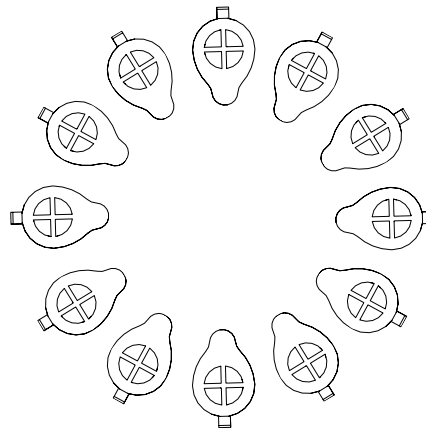
### 3 Run Preparation

Using the Fiberlite F55-12x1.5 MUC Rotor

#### Correct installed tubes



#### Incorrect installed tubes



### Close the rotor lid



Align the rotor lid with the center of the rotor body.

Align the arrow on the lid approximately with the #1 marking on the rotor body. Make sure that the O-rings are properly inserted and in perfect condition before closing the rotor lid.

Use the friction pad to hold the rotor on the centrifuge or a table.





Fasten the lid screw clockwise.



Use the lid fastening tool for closing the lid.

### **3 Run Preparation**

Using the Fiberlite F55-12x1.5 MUC Rotor

To start centrifugation put the rotor into the centrifuge and follow the instructions stated in the centrifuge manual.

## **Cleaning**

Clean the rotor with a soft cotton cloth and isopropyl alcohol or hydrogen peroxide 3%.

## Special operating conditions

Follow the instructions in this chapter if your sample has an average fluid density greater than 1.7 g/ml or if you are using a cesium chloride (CsCl) gradient. You may need to lower the speed of your run to reduce the stress on the rotor or to prevent CsCl from precipitating from solution.

Allowable speeds for sample density and density gradient medium .....	4-2
Compartment Loads in Excess of Design Mass .....	4-2
Precautions to Prevent Precipitation of Cesium Chloride .....	4-2

## 4 Special operating conditions

Allowable speeds for sample density and density gradient medium

### Allowable speeds for sample density and density gradient medium



**WARNING** Always reduce (derate) the rotor speed whenever the compartment load exceeds the maximum allowable compartment load (an average fluid density of 1.7 g/ml - 1.2 g/ml or less for the S50A and S58-A Rotor). Failure to reduce rotor speed under these conditions can cause rotor failure and subsequent centrifuge damage and sample loss. It can also cause personal injury if there is a hazardous sample.

### Compartment Loads in Excess of Design Mass

The maximum run speed for each Thermo Scientific Micro-Ultracentrifuge Rotor is based on a tube filled with sample having an average fluid density of 1.7 g/ml or less (1.2 g/ml or less for the S50-A and S58-A Rotor). To prevent rotor failure, the total contents of each compartment should not exceed this average density unless rotor speed is reduced proportionately.

Strict adherence to the reduced speed is required to prevent rotor failure. Observe the WARNING.

$$\text{Reduced Speed} = \text{Maximum Rotor Speed} \times \sqrt{\frac{1.7}{\text{average fluid density}}}$$

The deration formula does not apply when using gradients that can precipitate (see below).

### Precautions to Prevent Precipitation of Cesium Chloride



**WARNING** Always reduce (derate) the rotor speed whenever the rotor speed/ temperature combination exceeds the solubility of the gradient material and causes it to precipitate. Failure to reduce rotor speed under these conditions can cause rotor failure and subsequent centrifuge damage and sample loss. It can also cause personal injury if there is a hazardous sample.

Observe the WARNING. The maximum rotor speed must be reduced for samples with an average fluid density greater than 1.7 g/ml (see the square-root deration formula above) to prevent excessive hydraulic pressure on a rotor. Although use of the standard deration formula (see above) is appropriate for gradient materials with high solubility points, it will not prevent the precipitation of heavy crystals when material such as cesium chloride (CsCl) is used in a micro-ultracentrifuge.

**Note** An example in the text is illustrated in figure 4-1 (S150-AT Rotor) only. Apply the methods explained to the curves given for the other rotors.

When solid, crystalline CsCl forms, it places a density of 4 g/ml along the outside edge of each tube compartment. This density is dangerously high and can cause the rotor to fail, with subsequent centrifuge damage and sample loss. Therefore, cesium chloride solutions must be run at a reduced (derated) speed to avoid precipitation. The allowable maximum speed is determined by the average density of the CsCl solution and the run temperature.

The curves in figure 4-1 are used to determine the maximum operating speed at 4 °C and 20°C that will prevent precipitation in the S150-AT rotor. Figure 4-1 also includes a curve showing the standard speed (square-root) reduction that is used to avoid excessive hydraulic pressure only. The standard, square-root deration formula cannot be used when precipitation of CsCl must be considered. For example, standard speed reduction would allow you to run a solution having a density of 1.6 g/ml to the maximum rotor speed (150 000 rpm) at either 4 °C or 20 °C. However, a CsCl solution will precipitate at this speed. The graph shows the highest speed you can run a cesium chloride solution of this density (1.6 g/ml) is 98,000 rpm at 4 °C or 110,000 rpm at 20 °C.

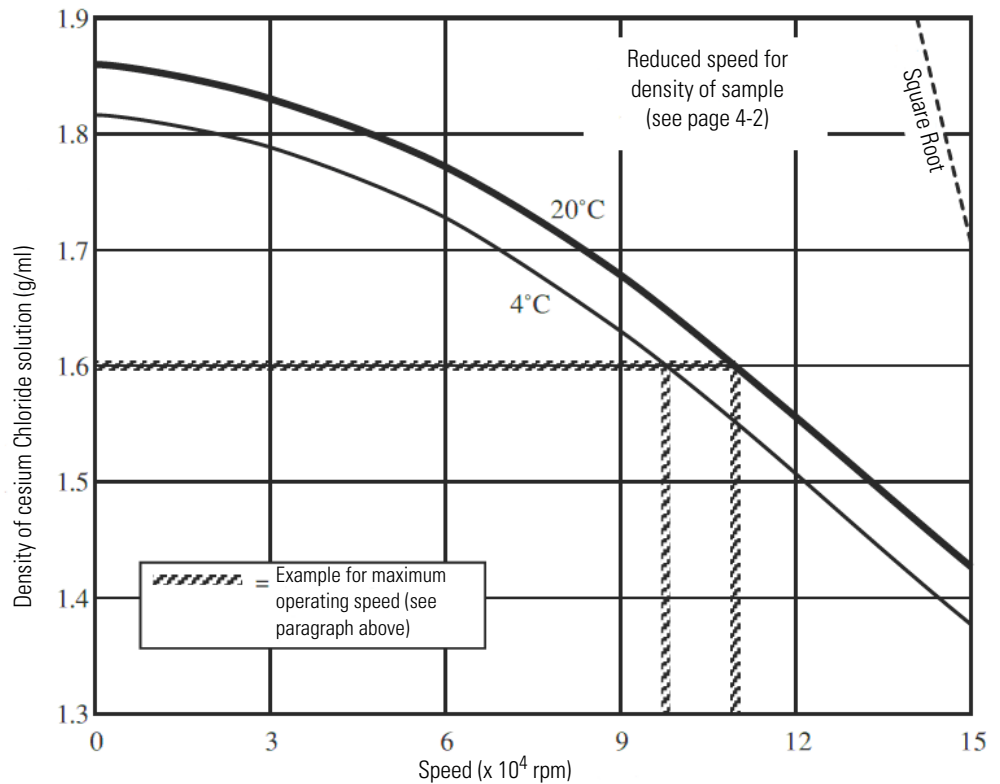
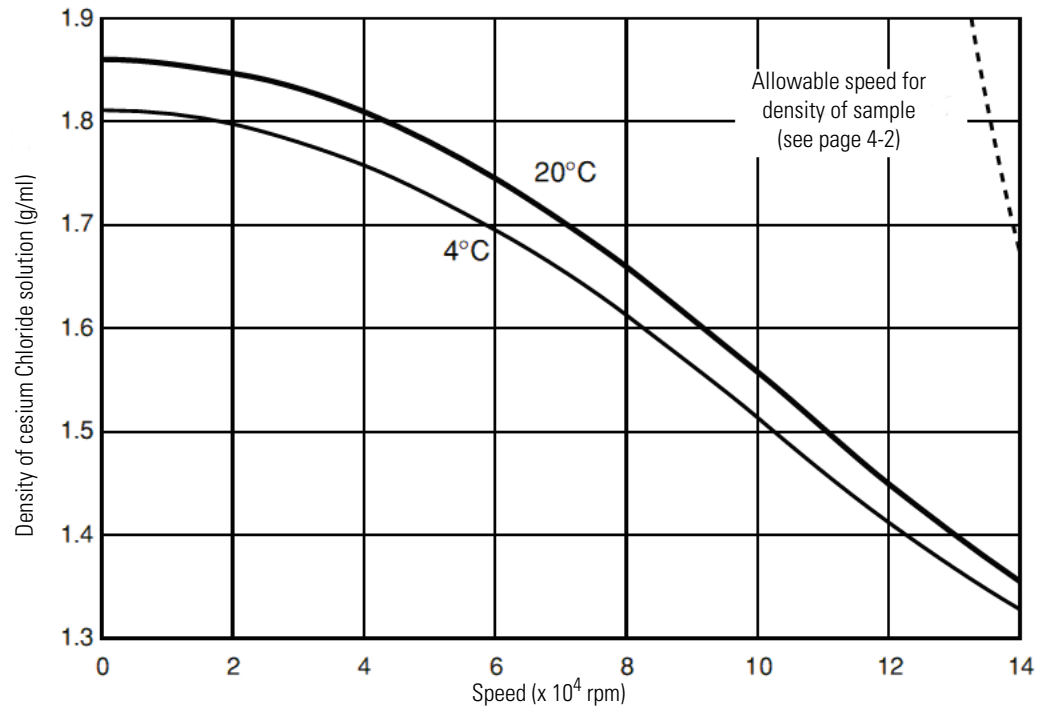


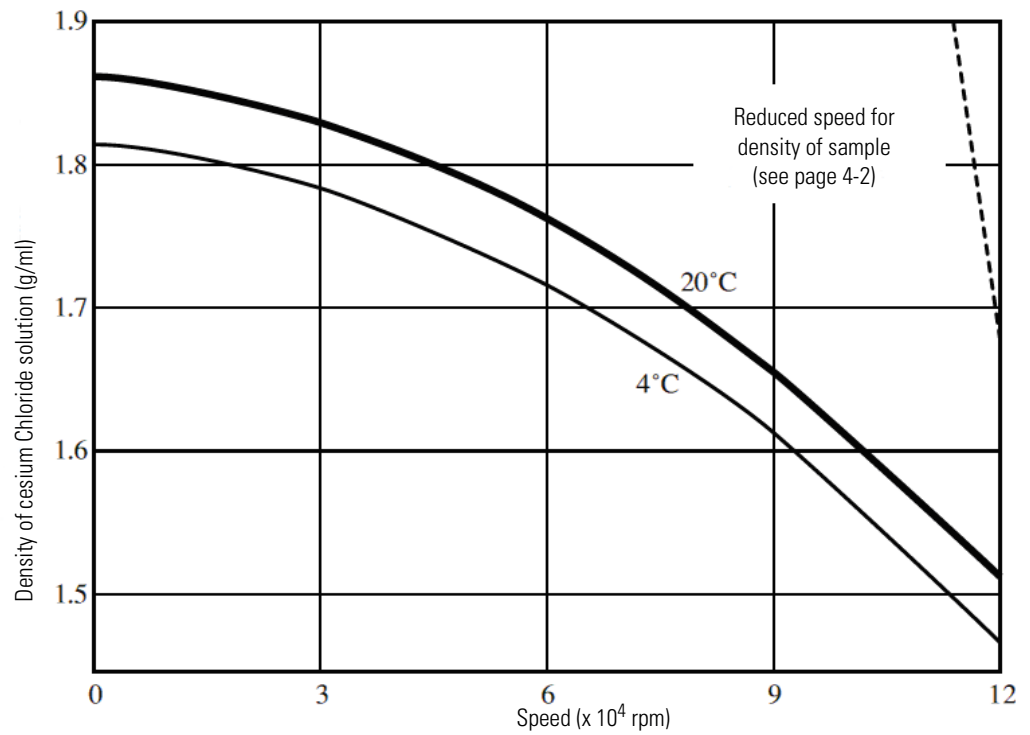
Figure 4-1 CsCl Precipitation Curves for the S150-AT Rotor

#### 4 Special operating conditions

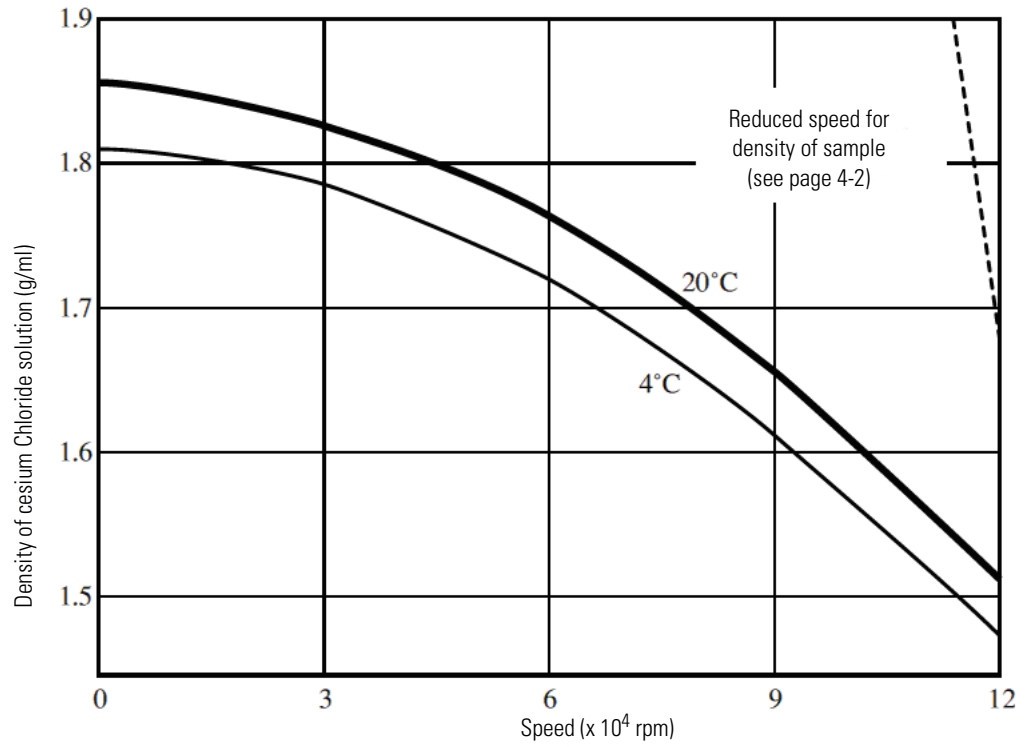
##### Precautions to Prevent Precipitation of Cesium Chloride



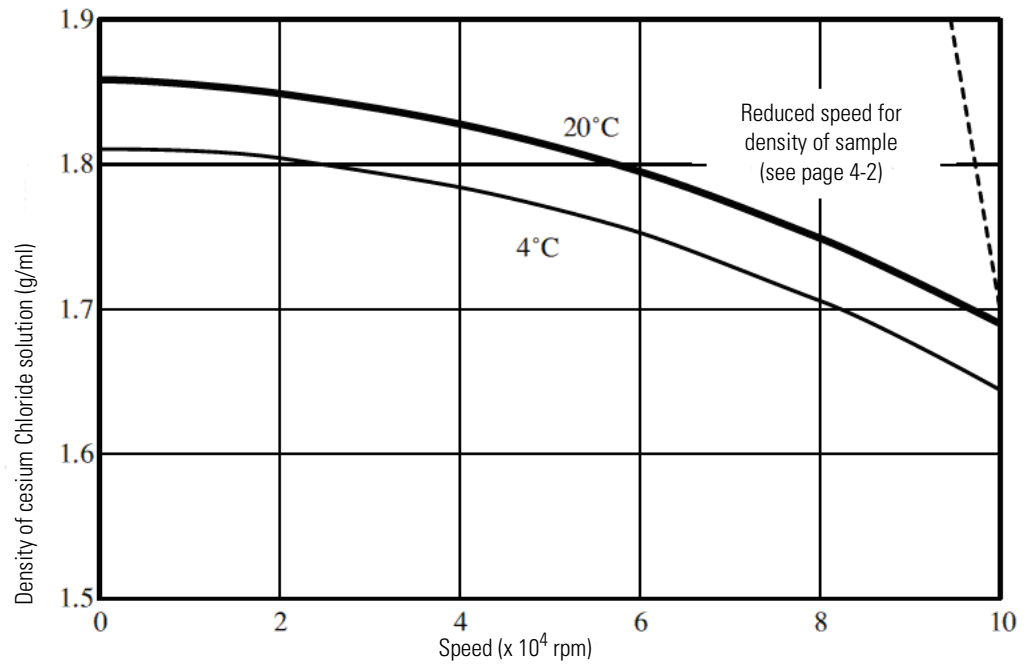
**Figure 4-2** CsCl Precipitation Curves for the S140-AT Rotor



**Figure 4-3** CsCl Precipitation Curves for the S120-AT Rotor



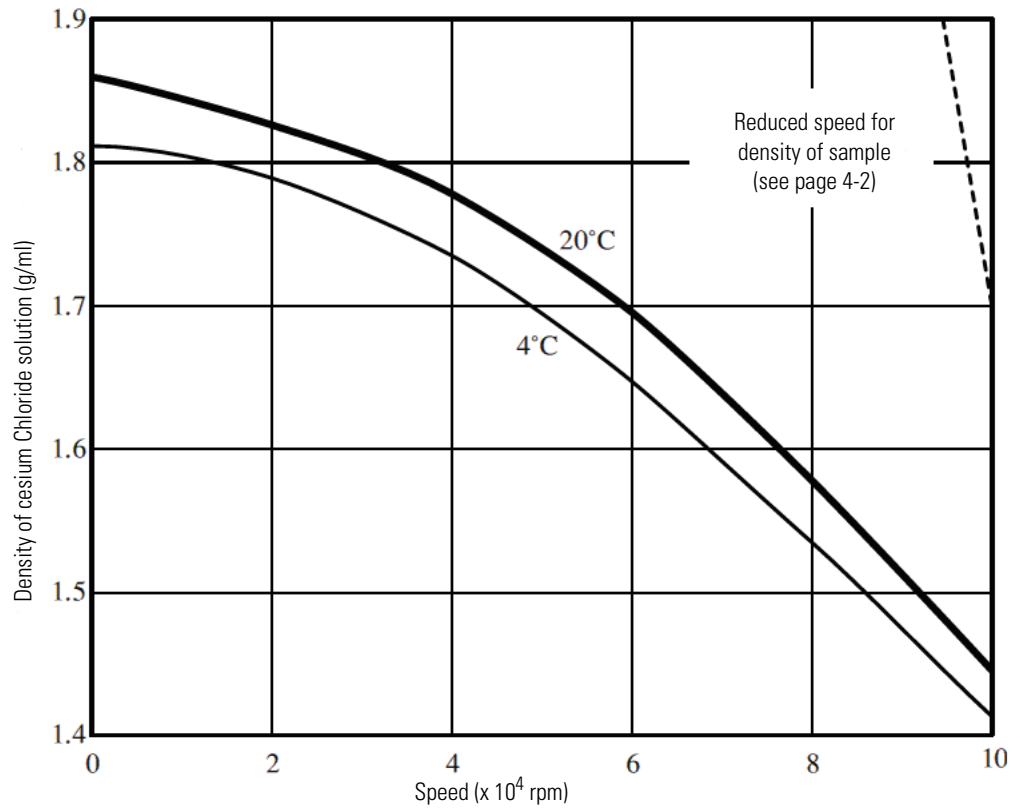
**Figure 4-4** CsCl Precipitation Curves for the S120-AT3 Rotor



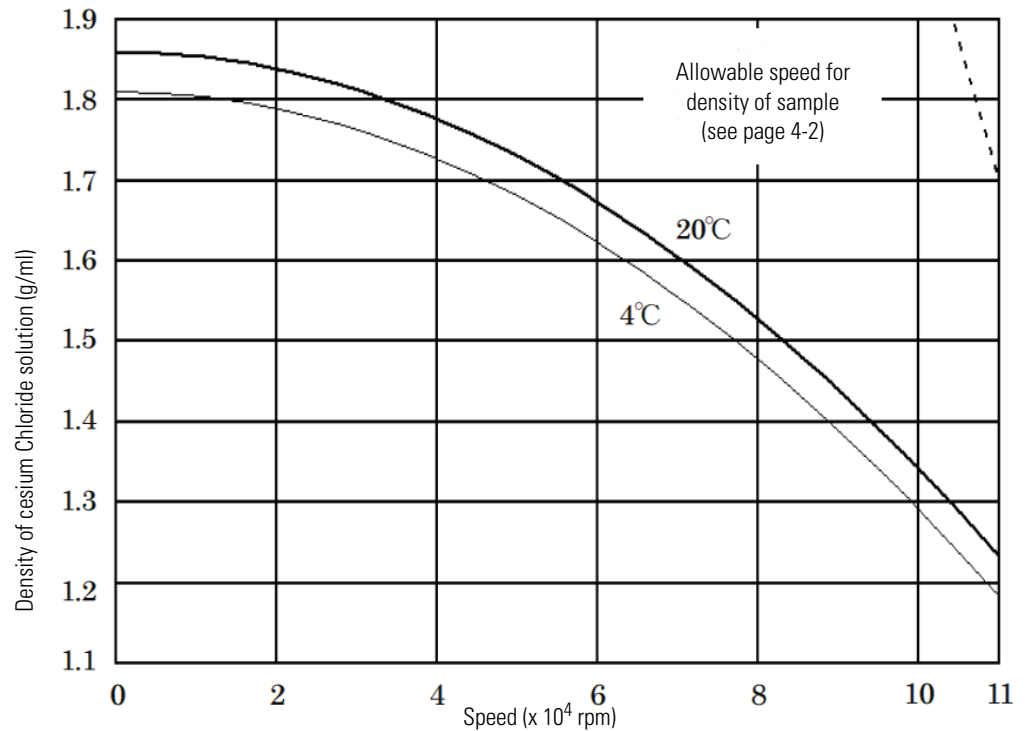
**Figure 4-5** CsCl Precipitation Curves for the S100-AT3 Rotor

#### 4 Special operating conditions

##### Precautions to Prevent Precipitation of Cesium Chloride

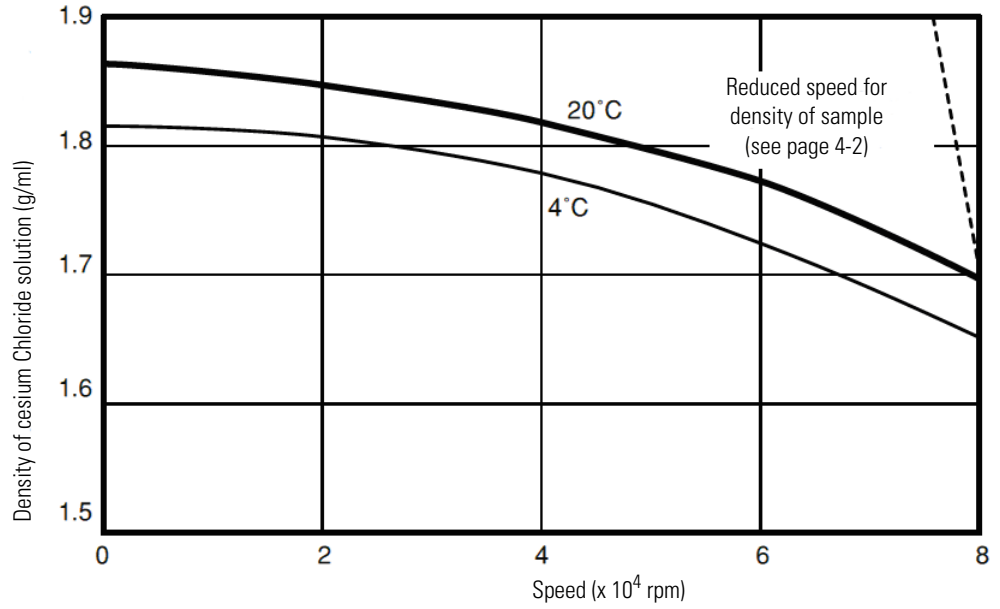


**Figure 4-6** CsCl Precipitation Curves for the S100-AT4 Rotor

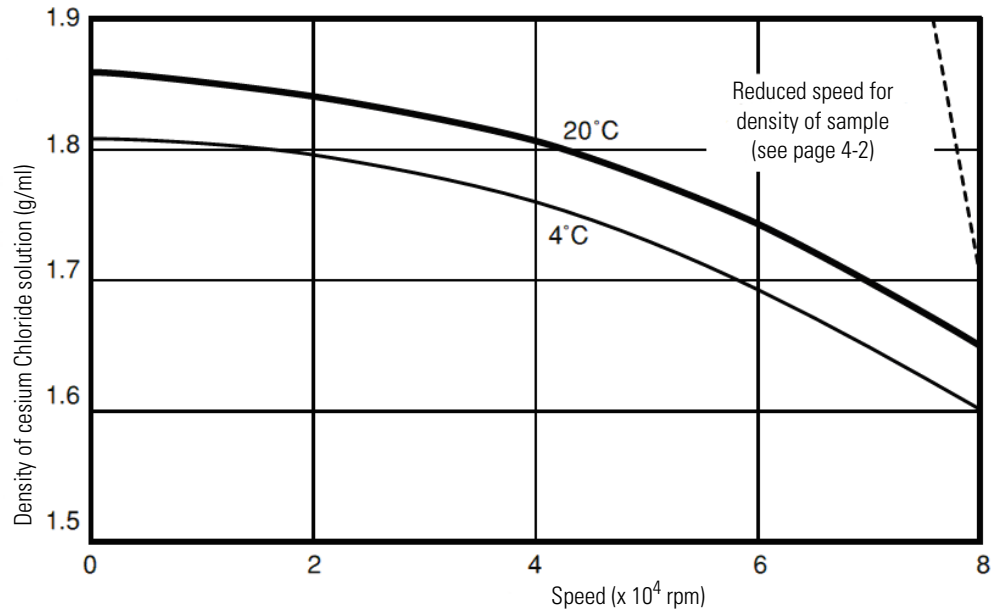


**Figure 4-7** CsCl Precipitation Curves for the S110-AT Rotor





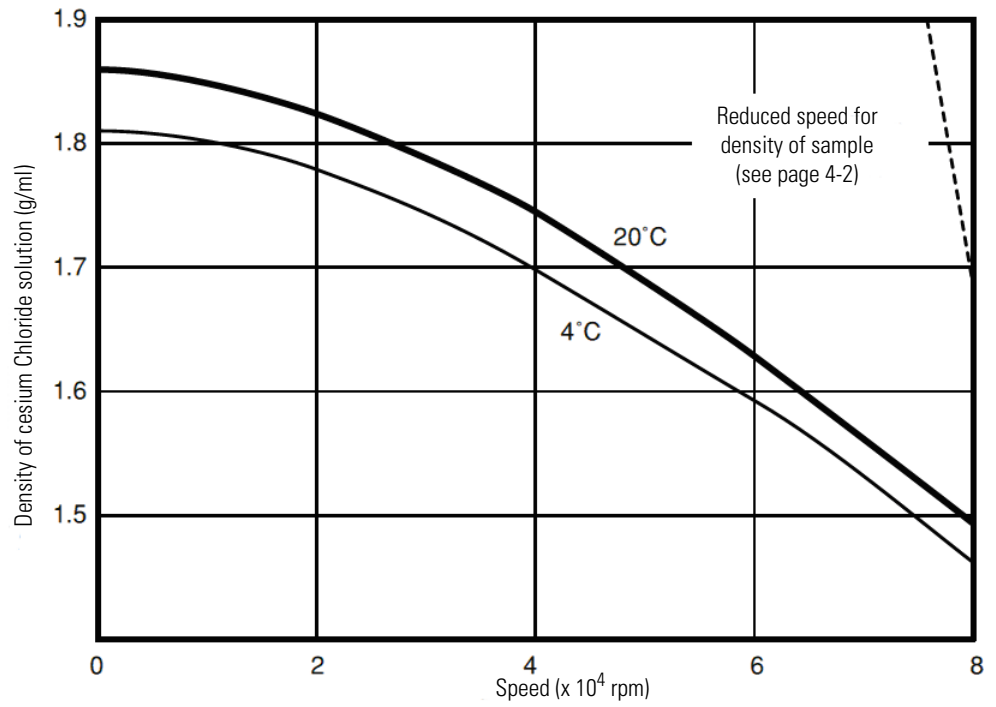
**Figure 4-8** CsCl Precipitation Curves for the S80-AT2 Rotor (inside)



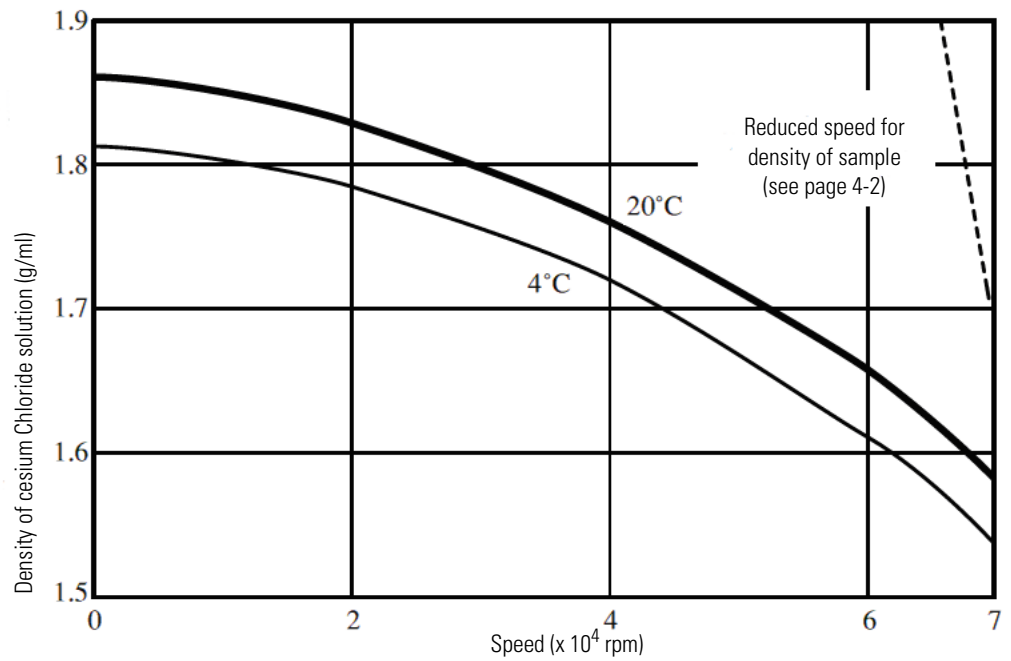
**Figure 4-9** CsCl Precipitation Curves for the S80-AT2 Rotor (outside)

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##### Precautions to Prevent Precipitation of Cesium Chloride



**Figure 4-10** CsCl Precipitation Curves for the S80-AT3 Rotor



**Figure 4-11** CsCl Precipitation Curves for the S70-AT Rotor

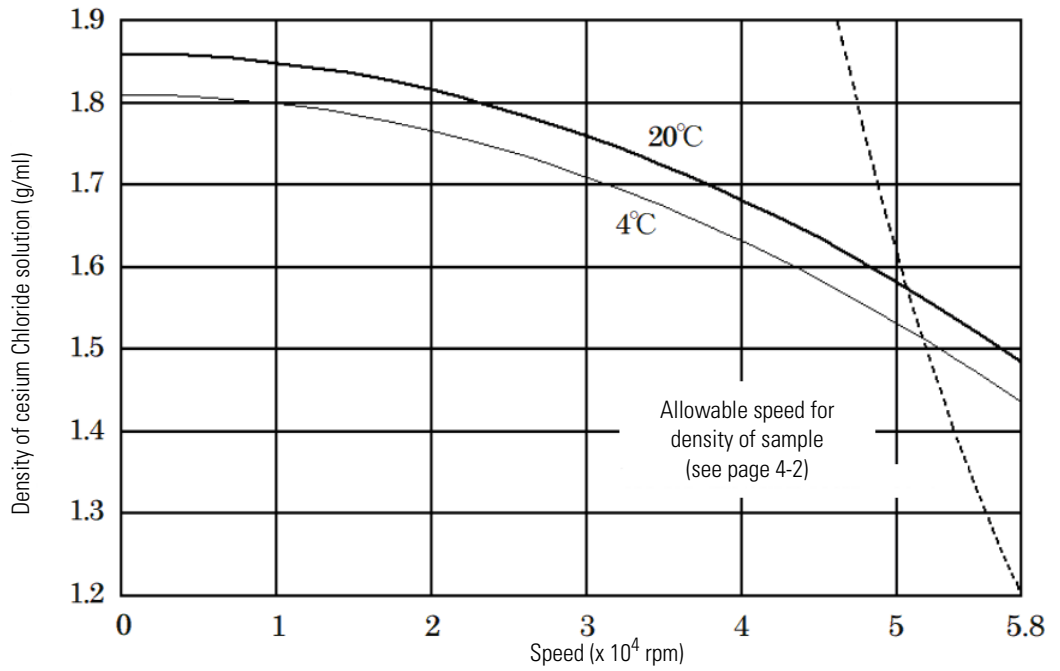


Figure 4-12 CsCl Precipitation Curves for the S58-A Rotor

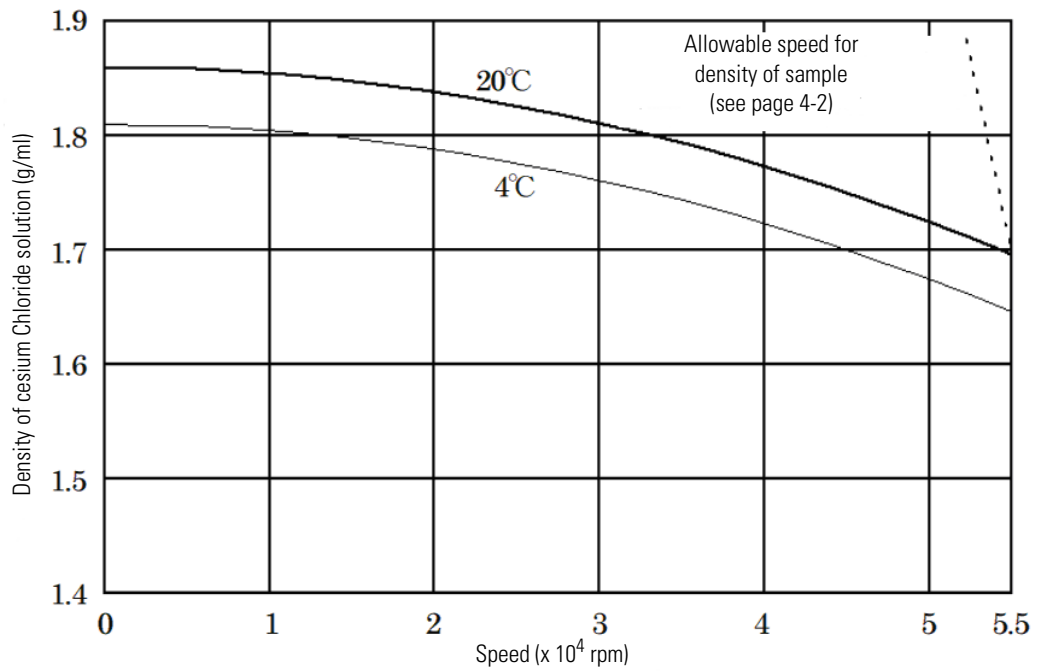
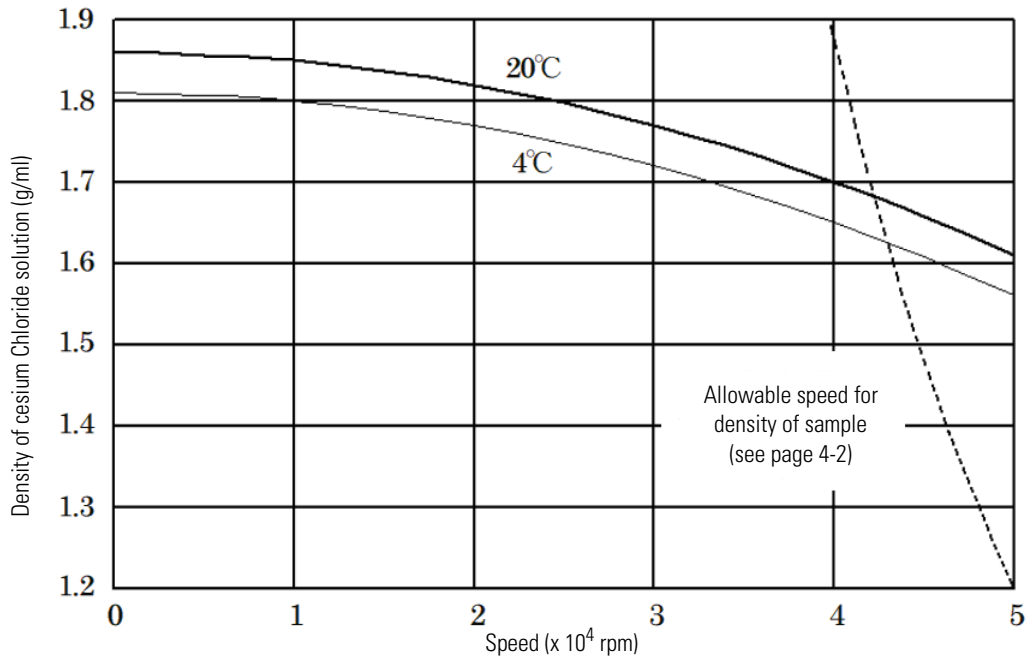


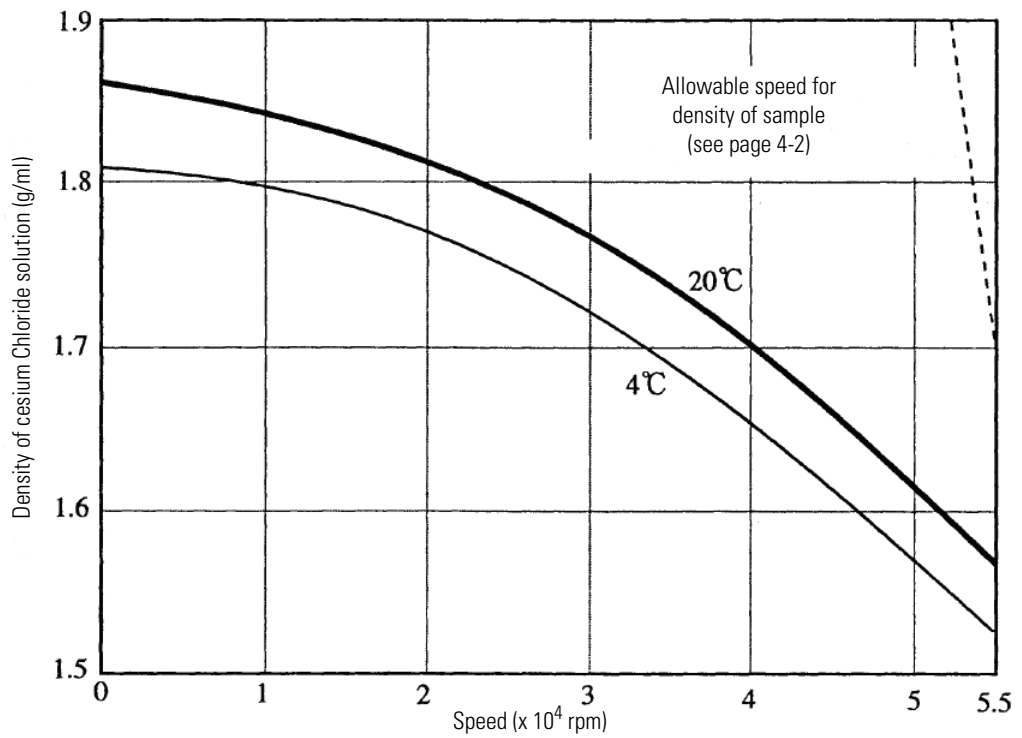
Figure 4-13 CsCl Precipitation Curves for the S55-A2 Rotor

#### 4 Special operating conditions

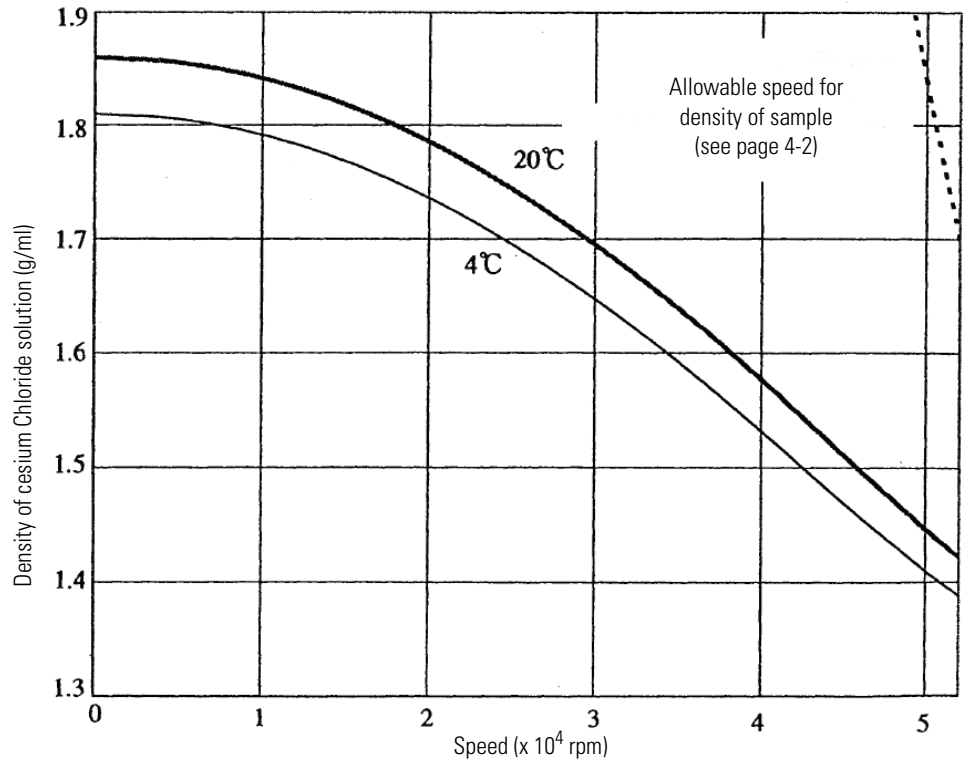
##### Precautions to Prevent Precipitation of Cesium Chloride



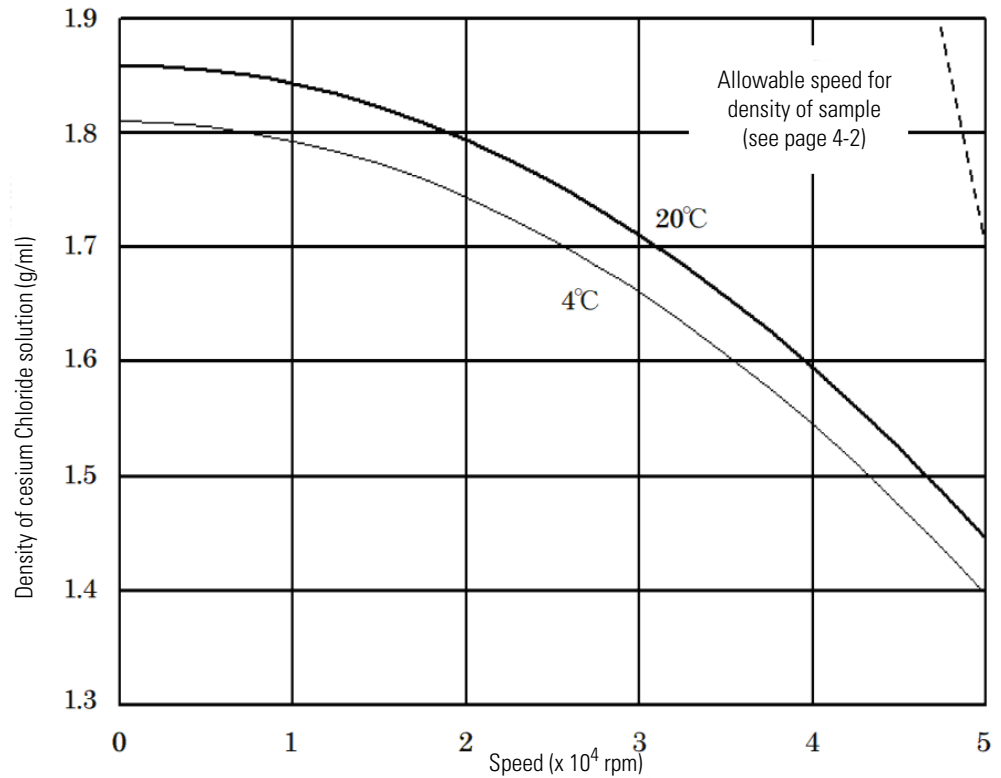
**Figure 4-14** CsCl Precipitation Curves for the S50-A Rotor



**Figure 4-15** CsCl Precipitation Curves for the S55-S Rotor



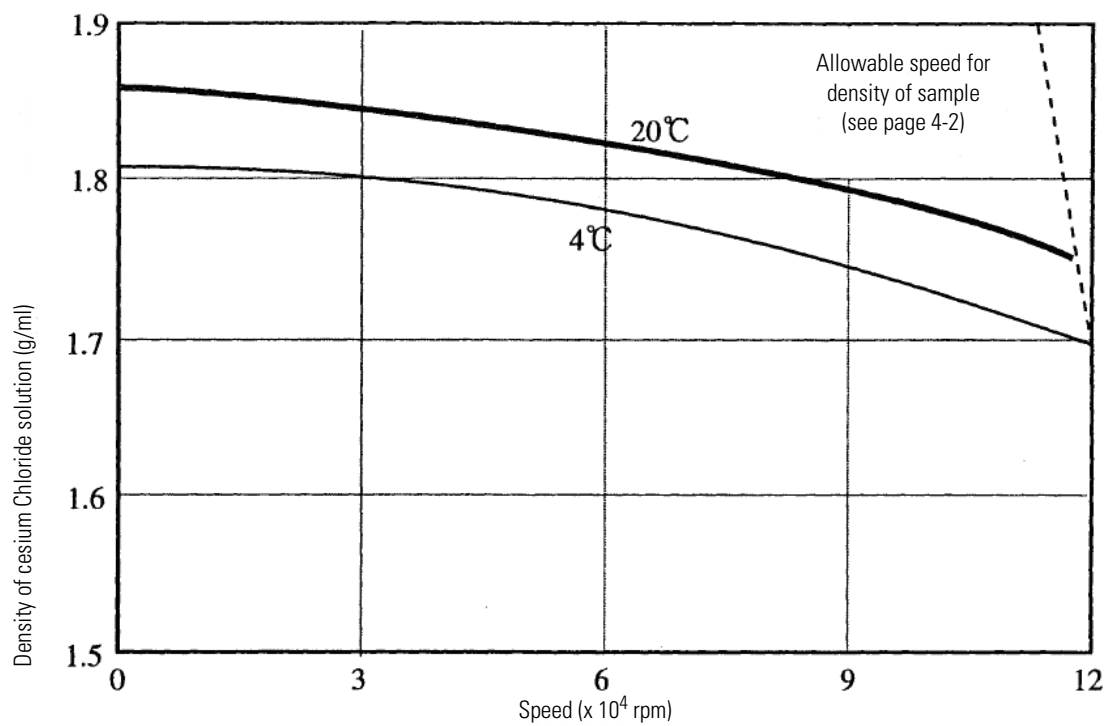
**Figure 4-16** CsCl Precipitation Curves for the S52-ST Rotor



**Figure 4-17** CsCl Precipitation Curves for the S50-ST Rotor

#### 4 Special operating conditions

##### Precautions to Prevent Precipitation of Cesium Chloride



**Figure 4-18** CsCl Precipitation Curves for the S120-VT Rotor

## Technical Notes

This chapter contains technical information on the calculation of relative centrifugal force (RCF) and sedimentation time. It also includes a chart for each micro-ultracentrifuge rotor that lists RCF values and K factors.

Relative Centrifugal Force (RCF) Determination .....	5-2
Calculation of Sedimentation Time in Aqueous (Non-Gradient) Solutions .....	5-4

## Relative Centrifugal Force (RCF) Determination

Relative centrifugal force (RCF) refers to the force during centrifugation that moves the particulate outward from the center of rotation. This force is proportional to the radial distance and the square of the rotor speed. The RCF value is determined by the following formula:

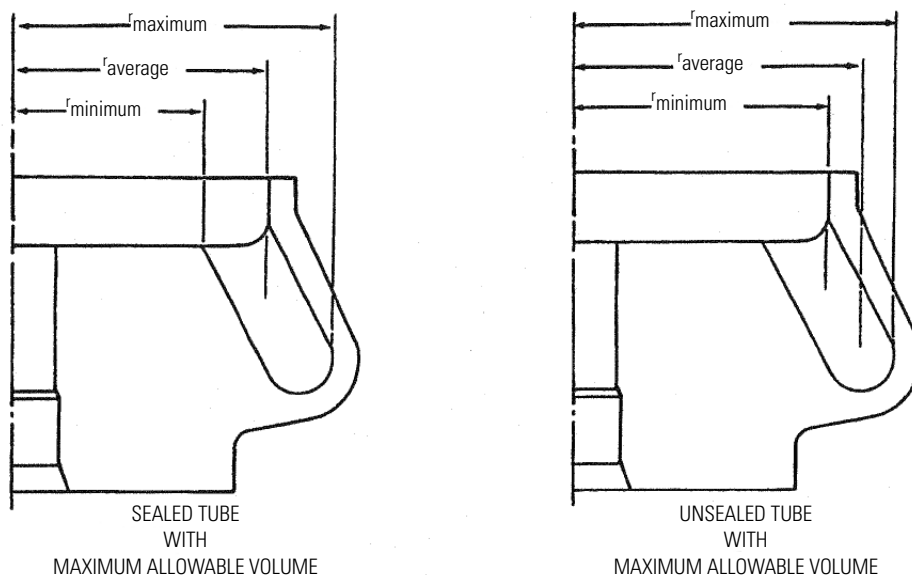
$$\text{RCF} = 11.18 (r) \left( \frac{\text{rpm}}{1000} \right)^2$$

when  $r$  = the radius in centimeters from the centerline of the rotor to the point in the tube where RCF value is required

and rpm = the rotor speed in revolutions per minute

Figure 5-1 shows the point of measurement for the minimum, average, and maximum radii. The illustration on the left is for a sealed tube with the maximum allowable volume and the one on the right shows an unsealed tube with maximum allowable fluid volume. Table 5-1 provides the actual radii values for select rotors when using either a sealed tube and an unsealed tube. Tables 5-2 through 5-20 provide the RCF values at each radius for all the micro-ultracentrifuge rotors; the values are provided at various speeds up to the maximum rotor speed. The RCF value at any other speed can be calculated by using the formula given above.

If using less than the maximum allowable fluid volume in a tube, the minimum and average radius will change depending on the amount of fluid. The maximum radius is a fixed distance that will not change, unless adapters are used.



**Figure 5-1** Cross section of rotor showing radial distances



Rotor	Sealed Tube with Maximum Allowable Volume <sup>1</sup>			Unsealed Tube with Maximum Allowable Volume <sup>1</sup>		
	r <sub>maximum</sub>	r <sub>average</sub>	r <sub>minimum</sub>	r <sub>maximum</sub>	r <sub>average</sub>	r <sub>minimum</sub>
F55-12x1.5MUC	6.54	5.16	3.76			
S 150-AT	3.58	2.34	1.1	3.58	2.83	2.08
S120-AT2	4.04	2.82	1.6	4.04	3.195	2.35
S120-AT3	4.04	2.93	1.82	4.04	3.195	2.35
S100-AT3	3.9	3.205	2.51	3.9	3.475	3.05
S100-AT4	4.84	3.14	1.44	4.84	3.72	2.6
S100-AT6	5.4	3.565	1.73	5.4	4	2.6
S80-AT2 <sup>2</sup>	5.00/4.25	3.93/3.175	2.86/2.10	5.00/4.25	4.125/3.52	3.25/2.79
S80-AT3	5.8	3.975	2.15	5.8	4.45	3.1
S70-AT	5.61	4.025	2.44	5.61	4.345	3.08
S45-A	5.52	4.005	2.49			

**Table 5-1** Radii values for Sealed and Unsealed Tubes

1. Radii values are given in centimeters and are the actual rotor specifications; these values do not take the thickness of the tube into consideration.

2. The S80-AT2 outer row value is listed first, followed by the inner row value.

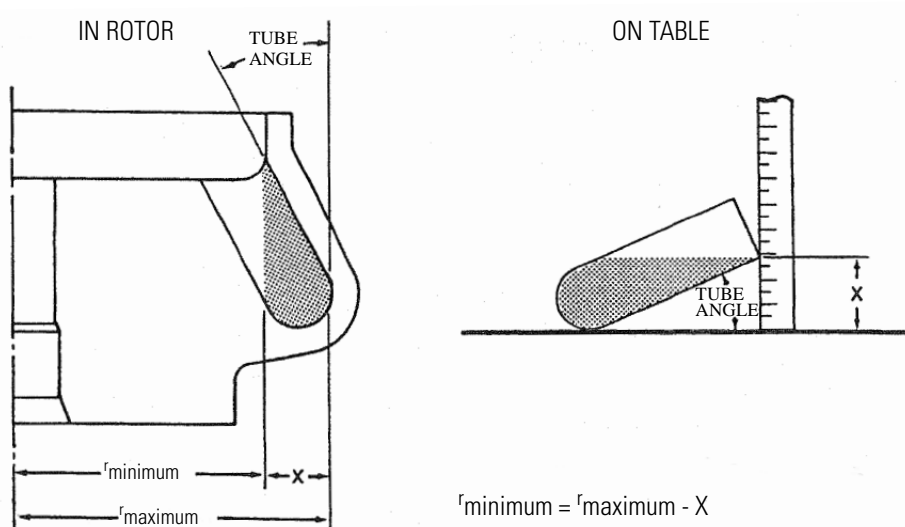
To determine the minimum radius for a partially filled tube:

Fill the tube with the desired amount of fluid. Hold the tube on a table at the rotor's tube angle\* then measure the distance from the table to the top of the fluid column (see figure 5-2).

Subtract this distance from the maximum radius—the difference is the minimum radius.

The average radius is simply one-half the sum of the minimum and maximum radii.

RCF values can now be determined for these radii by using the formula given.



**Figure 5-2** Determining the Minimum Radius of a Partially Filled Tube

## Calculation of Sedimentation Time in Aqueous (Non-Gradient) Solutions

The time required to sediment a particle in water at 20 °C through the maximum rotor path length (that is, the distance between  $r_{\text{minimum}}$  and  $r_{\text{maximum}}$ ) can be calculated using the equation:

$$t = \frac{K}{S_{20, w}}$$

where:

$t$  = sedimentation time in hours

$K$  = the clearing factor for the rotor (defined below)

$S_{20, w}$  = the sedimentation coefficient for the particle of interest in water at 20 °C expressed in Svedbergs\*

The clearing, or  $K$ , factor is defined by the equation:

$$K = (253\,000) \left[ \ln \left( \frac{r_{\text{maximum}}}{r_{\text{minimum}}} \right) \right] \div \left( \frac{\text{rotor speed}}{1000} \right)^2$$

Where  $r_{\text{maximum}}$  and  $r_{\text{minimum}}$  are the maximum and minimum rotor radii, respectively, and rotor speed is expressed in rpm.

$K$  factors for each rotor is listed in tables 5-2 through 5-12.

EXAMPLE: The S100-AT3 Rotor has a  $K$  factor of 11.1 at the maximum permitted speed (100,000 rpm). If the particles to be sedimented have a sedimentation coefficient of 29S, the estimated run time required at maximum speed will be:

$$t = \frac{11.1}{29S} = 0.3 \text{ hours} = 49 \text{ minutes}$$

Note that the calculation assumes particles in water at 20 °C. If the suspending medium is denser or more viscous than water, the sedimentation time will be greater.

\* The sedimentation coefficient ( $S$ ) in seconds, for a particle in a centrifugal field is defined by the equation

$$S = (dx/dt) [1/(\omega^2 x)];$$

where  $dx/dt$  = sedimentation velocity of the particle in cm/s;

$\omega$  = rotor speed in rad/s; and

$x$  = the distance of the particle from the axis of rotation in centimeters.

Conventionally, experimentally determined values of sedimentation coefficients are multiplied by 1013 to convert them to Svedberg units (S), so a particle with an experimentally determined sedimentation coefficient of 10-11 seconds is usually referred to in the literature as a “100 S particle.” Since the value determined for the sedimentation coefficient is dependent on the density and viscosity of the solution in which centrifugation is performed, values are usually reported for the standard conditions of infinite dilution in water at 20 °C, and designated  $S_{20, w}$ .

Speed (rpm)	Max. R.C.F. (× g)			K-Factor
	Rmin (2.08cm)	Rav (2.83cm)	Rmax (3.58cm)	
10,000	2,323	3,161	3,999	1,375
20,000	9,293	12,644	15,995	344
30,000	20,910	28,450	35,990	153
40,000	37,174	50,578	63,982	86
50,000	58,084	79,028	99,972	55
60,000	83,641	113,800	143,959	38
70,000	113,845	154,894	195,944	28
80,000	148,695	202,311	255,927	21
90,000	188,192	256,050	323,908	17
100,000	232,336	316,111	399,886	14
110,000	281,127	382,494	483,862	11
120,000	334,564	455,200	575,836	10
130,000	392,648	534,228	675,807	8
140,000	455,379	619,578	783,777	7
150,000	522,756	711,250	899,744	6

**Table 5-2** RCF Values and K-factors for Sealed Tubes in the S150-AT Fixed Angle Rotor

Speed (rpm)	Max. R.C.F.(× g)			K-Factor
	Rmin (3.26cm)	Rav (4.03cm)	Rmax (4.79cm)	
10,000	3,641	4,502	5,350	975
20,000	14,566	18,006	21,402	244
30,000	32,773	40,514	48,154	108
40,000	58,263	72,024	85,607	61
50,000	91,036	112,538	133,761	39
60,000	131,091	162,054	192,615	27
70,000	178,430	220,574	262,171	20
80,000	233,051	288,097	342,428	15
90,000	294,955	364,622	433,385	12
100,000	364,142	450,151	535,043	10
110,000	440,612	544,683	647,402	8
120,000	524,364	648,217	770,462	7
130,000	615,400	760,755	904,223	6
140,000	713,718	882,296	1,048,684	5

**Table 5-3** RCF Values and K-factors for Sealed Tubes in the S140-AT Fixed Angle Rotor

## 5 Technical Notes

### Calculation of Sedimentation Time in Aqueous (Non-Gradient) Solutions

Speed (rpm)	Max. R.C.F.(×g)			K-Factor
	Rmin (2.54 cm)	Rav (3.29 cm)	Rmax (4.04 cm)	
10,000	2,837	3,675	4,513	1,176
20,000	11,349	14,700	18,051	294
30,000	25,535	33,074	40,614	131
40,000	45,395	58,799	72,203	73
50,000	70,930	91,873	112,817	47
60,000	102,138	132,297	162,456	33
70,000	139,022	180,072	221,121	24
80,000	181,580	235,196	288,812	18
90,000	229,812	297,669	365,527	15
100,000	283,718	367,493	451,268	12
110,000	343,299	444,667	546,034	10
120,000	408,554	529,190	649,826	8

**Table 5-4** RCF Values and K-factors for Sealed Tubes in the S120-AT2 Fixed Angle Rotor

Speed (rpm)	Max. R.C.F.(×g)			K-Factor
	Rmin (2.59 cm)	Rav (3.32 cm)	Rmax (4.04 cm)	
10,000	2,893	3,708	4,513	1,126
20,000	11,572	14,834	18,051	282
30,000	26,037	33,376	40,614	125
40,000	46,288	59,335	72,203	70
50,000	72,326	92,711	112,817	45
60,000	104,149	133,504	162,456	31
70,000	141,758	181,714	221,121	23
80,000	185,154	237,340	288,812	18
90,000	234,335	300,384	365,527	14
100,000	289,303	370,844	451,268	11
110,000	350,057	448,721	546,034	9
120,000	416,596	534,015	649,826	8

**Table 5-5** RCF Values and K-factors for Sealed Tubes in the S120-AT3 Fixed Angle Rotor

Speed (rpm)	Max. R.C.F.(×g)			K-Factor
	Rmin (2.45cm)	Rav (3.78cm)	Rmax (5.11cm)	
10,000	2,737	4,222	5,708	1,862
20,000	10,947	16,889	22,831	466
30,000	24,630	38,000	51,371	207
40,000	43,786	67,556	91,326	116
50,000	68,416	105,557	142,697	74
60,000	98,519	152,001	205,483	52
70,000	134,096	206,891	279,686	38
80,000	175,146	270,225	365,304	29
90,000	221,669	342,003	462,337	23
100,000	273,665	422,226	570,787	19
110,000	331,135	510,893	690,652	15

**Table 5-6** RCF Values and K-factors for Sealed Tubes in the S110-AT Fixed Angle Rotor

Speed (rpm)	Max. R.C.F.(×g)			K-Factor
	Rmin (2.96cm)	Rav (3.43cm)	Rmax (3.90cm)	
10,000	3,306	3,831	4,356	699
20,000	13,225	15,325	17,425	175
30,000	29,757	34,482	39,207	78
40,000	52,901	61,301	69,701	44
50,000	82,658	95,783	108,908	28
60,000	119,028	137,927	156,827	19
70,000	162,010	187,734	213,459	14
80,000	211,604	245,204	278,803	11
90,000	267,812	310,336	352,860	9
100,000	330,632	383,131	435,630	7

**Table 5-7** RCF Values and K-factors for Sealed Tubes in the S100-AT3 Fixed Angle Rotor

## 5 Technical Notes

### Calculation of Sedimentation Time in Aqueous (Non-Gradient) Solutions

Speed (rpm)	Max. R.C.F.(×g)			K-Factor
	Rmin (2.58cm)	Rav (3.71cm)	Rmax (4.84cm)	
10,000	2,882	4,144	5,406	1,594
20,000	11,527	16,576	21,625	398
30,000	25,937	37,297	48,657	177
40,000	46,110	66,305	86,500	100
50,000	72,047	103,602	135,157	64
60,000	103,747	149,187	194,626	44
70,000	141,211	203,059	264,908	33
80,000	184,439	265,220	346,002	25
90,000	233,431	335,670	437,909	20
100,000	288,186	414,407	540,628	16

**Table 5-8** RCF Values and K-factors for Sealed Tubes in the S100-AT4 Fixed Angle Rotor

Speed (rpm)	Max. R.C.F.(×g)			K-Factor
	Rmin (2.80cm)	Rav (3.53cm)	Rmax (4.25cm)	
10,000	3,128	3,943	4,747	1,057
20,000	12,510	15,772	18,989	264
30,000	28,148	35,487	42,725	117
40,000	50,042	63,088	75,956	66
50,000	78,190	98,575	118,681	42
60,000	112,594	141,948	170,901	29
70,000	153,252	193,207	232,615	22
80,000	200,166	252,353	303,824	17

**Table 5-9** RCF Values and K-factors for Sealed Tubes in the S80-AT2 Fixed Angle Rotor (Inside Row)

Speed (rpm)	Max. R.C.F.(×g)			K-Factor
	Rmin (3.55cm)	Rav (4.28cm)	Rmax (5.00cm)	
10,000	3,965	4,781	5,585	868
20,000	15,861	19,123	22,340	217
30,000	35,688	43,027	50,265	96
40,000	63,446	76,492	89,360	54
50,000	99,134	119,519	139,625	35
60,000	142,753	172,107	201,060	24
70,000	194,302	234,257	273,665	18
80,000	253,782	305,969	357,440	14

**Table 5-10** RCF Values and K-factors for Sealed Tubes in the S80-AT2 Fixed Angle Rotor (Outside Row)

Speed (rpm)	Max. R.C.F. (×g)			K-Factor
	Rmin (3.23cm)	Rav (4.52cm)	Rmax (5.80cm)	
10,000	3,608	5,049	6,479	1,483
20,000	14,432	20,195	25,914	371
30,000	32,471	45,440	58,307	165
40,000	57,727	80,781	103,658	93
50,000	90,198	126,221	161,965	59
60,000	129,885	181,758	233,230	41
70,000	176,788	247,393	317,451	30
80,000	230,906	323,126	414,630	23

**Table 5-11** RCF Values and K-factors for Sealed Tubes in the S80-AT3 Fixed Angle Rotor

Speed (rpm)	Max. R.C.F. (×g)			K-Factor
	Rmin (3.10cm)	Rav (4.36cm)	Rmax (5.61cm)	
10,000	3,463	4,870	6,266	1,502
20,000	13,851	19,480	25,065	376
30,000	31,164	43,831	56,397	167
40,000	55,403	77,922	100,262	94
50,000	86,568	121,753	156,659	60
60,000	124,657	175,324	225,589	42
70,000	169,672	238,636	307,052	31

**Table 5-12** RCF Values and K-factors for Sealed Tubes in the S70-AT Fixed Angle Rotor

## 5 Technical Notes

### Calculation of Sedimentation Time in Aqueous (Non-Gradient) Solutions

Speed (rpm)	Max. R.C.F. (×g)			K-Factor
	Rmin (3.96cm)	Rav (5.83cm)	Rmax (7.69cm)	
10,000	4,423	6,512	8,590	1,681
15,000	9,952	14,652	19,327	747
20,000	17,693	26,048	34,359	420
25,000	27,646	40,701	53,686	269
30,000	39,810	58,609	77,308	187
35,000	54,186	79,773	105,224	137
40,000	70,773	104,194	137,436	105
45,000	89,572	131,870	173,942	83
50,000	110,583	162,803	214,743	67
55,000	133,805	196,991	259,839	56
58,000	148,800	219,067	288,959	50

**Table 5-13** RCF Values and K-factors for Sealed Tubes in the S58-A Fixed Angle Rotor

Speed (rpm)	Max. R.C.F. (×g)			K-Factor
	Rmin (3.70cm)	Rav (4.83cm)	Rmax (5.95cm)	
5,000	1,033	1,349	1,662	4,813
10,000	4,133	5,395	6,646	1,203
15,000	9,299	12,139	14,954	535
20,000	16,532	21,580	26,585	301
25,000	25,831	33,719	41,538	193
30,000	37,196	48,556	59,815	134
35,000	50,628	66,090	81,415	98
40,000	66,126	86,322	106,338	75
45,000	83,691	109,251	134,585	59
50,000	103,323	134,878	166,154	48
55,000	125,020	163,202	201,046	40

**Table 5-14** RCF Values and K-factors for Sealed Tubes in the S55-A2 Fixed Angle Rotor



Speed (rpm)	Max. R.C.F. (×g)			K-Factor
	Rmin (4.12cm)	Rav (5.81cm)	Rmax (7.50cm)	
5,000	1,151	1,622	2,094	6,070
10,000	4,602	6,490	8,378	1517
15,000	10,355	14,602	18,849	674
20,000	18,408	25,959	33,510	379
25,000	28,763	40,561	52,359	243
30,000	41,418	58,408	75,398	169
35,000	56,375	79,500	102,624	124
40,000	73,633	103,836	134,040	95
45,000	93,191	131,418	169,644	75
50,000	115,051	162,244	209,438	61

**Table 5-15** RCF Values and K-factors for Sealed Tubes in the S50-A Fixed Angle Rotor

Speed (rpm)	Max. R.C.F. (×g)			K-Factor
	Rmin (3.76cm)	Rav (5.16cm)	Rmax (6.54cm)	
5,000	1,064	1,456	1,831	5,495
10,000	4,256	5,824	7,325	1,374
15,000	9,576	13,104	16,481	611
20,000	17,024	23,296	29,299	343
25,000	26,600	36,400	45,780	220
30,000	38,304	52,416	65,923	153
35,000	52,136	71,344	89,729	112
40,000	68,096	93,184	117,197	86
45,000	86,184	117,936	148,327	68
50,000	106,400	145,600	183,120	55
55,000	128,744	176,176	221,575	45

**Table 5-16** RCF Values and K-factors for Sealed Tubes in the F55-12x1.5MUC Fixed Angle Rotor

## 5 Technical Notes

### Calculation of Sedimentation Time in Aqueous (Non-Gradient) Solutions

Speed (rpm)	Max. R.C.F. (×g)			K-Factor
	Rmin (4.54cm)	Rav (6.10cm)	Rmax (7.66cm)	
10,000	5,071	6,814	8,556	1,468
15,000	11,410	15,331	19,251	653
20,000	20,285	27,255	34,225	367
25,000	31,695	42,586	53,476	235
30,000	45,641	61,323	77,006	163
35,000	62,122	83,468	104,814	120
40,000	81,139	109,019	136,900	92
45,000	102,691	137,977	173,263	73
50,000	126,780	170,343	213,906	59
55,000	153,403	206,114	258,826	44

**Table 5-17** RCF Values and K-factors for Sealed Tubes in the S55-S Swinging Bucket Rotor

Speed (rpm)	Centrifugal acceleration (×g)			K-Factor
	Rmin (3.94cm)	Rav (6.53cm)	Rmax (9.12cm)	
10,000	4,401	7,294	10,187	2,126
15,000	9,902	16,412	22,921	945
20,000	17,604	29,176	40,748	531
25,000	27,506	45,588	63,669	340
30,000	39,609	65,646	91,683	236
35,000	53,912	89,352	124,791	174
40,000	70,416	116,704	162,993	133
45,000	89,120	147,704	206,288	105
50,000	110,025	182,350	254,676	85
52,000	119,002	197,230	275,458	79

**Table 5-18** RCF Values and K-factors for Sealed Tubes in the S52-ST Swinging Bucket Rotor

Speed (rpm)	Centrifugal acceleration ( $\times g$ )			K-Factor
	Rmin (4.25cm)	Rav (6.65cm)	Rmax (9.05cm)	
5,000	1,187	1,857	2,527	7,658
10,000	4,747	7,428	10,109	1,915
15,000	10,681	16,713	22,745	851
20,000	18,989	29,712	40,435	479
25,000	29,670	46,425	63,180	306
30,000	42,725	66,852	90,980	213
35,000	58,154	90,994	123,833	156
40,000	75,956	118,849	161,742	120
45,000	96,132	150,418	204,704	95
50,000	118,681	185,701	252,721	77

**Table 5-19** RCF Values and K-factors for Sealed Tubes in the S50-ST Swinging Bucket Rotor

Speed (rpm)	Max. R.C.F. ( $\times g$ )			K-Factor
	Rmin (1.99cm)	Rav (2.55cm)	Rmax (3.11cm)	
10,000	2,223	2,848	3,474	1,131
20,000	8,891	11,393	13,895	283
30,000	20,005	25,635	31,265	126
40,000	35,565	45,574	55,582	71
50,000	55,571	71,209	86,847	45
60,000	80,022	102,541	125,059	31
70,000	108,919	139,569	170,220	23
80,000	142,261	182,294	222,328	18
90,000	180,049	230,716	281,383	14
100,000	222,283	284,835	347,387	11
110,000	268,962	344,650	420,338	9
120,000	320,088	410,162	500,237	8

**Table 5-20** RCF Values and K-factors for Sealed Tubes in the S120-VT Swinging Bucket Rotor



## Rotor Care and Maintenance

This chapter provides information on rotor corrosion, cleaning, decontamination, inspection, and storage. It also includes the Service Decontamination Policy.

Corrosion .....	6-2
Cleaning and Decontamination .....	6-3
Rotor Body .....	6-3
Rotor Cover Assembly .....	6-4
Cover Opener .....	6-4
Inspection .....	6-4
Storage .....	6-5
Service Decontamination .....	6-5

## Corrosion

The Thermo Scientific S45-A, S55-A, S55-A2, S58-A and S50-A Secure Locking Fixed Angle Micro-ultracentrifuge rotor bodies are made from an aluminum alloy, which is anodized to protect it from corrosion. Although the rotor's corrosion resistance is good, proper care of the rotor will minimize the chance of corrosion. All of the other secure locking fixed angle micro-ultracentrifuge rotor bodies are made of titanium. All of the rotor lids for the fixed angle and vertical rotors are anodized aluminum.

The Thermo Scientific S55-S swinging bucket rotor body is made from aluminum alloy for high strength to weight ratio, and the S50-ST and S52-ST swinging bucket rotor bodies are made from titanium. Both rotor buckets are made of titanium.

Although aluminum corrosion resistance is good, it is not as good as stainless steel or titanium. However all rotors regardless of material composition should be maintained and kept clean. With proper care, corrosion can be minimized to significantly prolong the life of the rotor and lessen the chances of rotor failure and potential damage to the centrifuge.

Corrosion commonly refers to chemical reactions at the surface (that is, rusting or pitting) recognized by the growing areas of visible deterioration. On the other hand, stress corrosion attacks the inside of the metal as well; barely detectable surface cracks grow inward, weakening the part without visible warning. Stress corrosion applies to most commonly used alloys, even the corrosion-resistant alloys have been found susceptible.

Stress corrosion is thought to be initiated by certain combinations of stress and chemical reaction. The most common chemical causing harmful effects is chloride, whether in a solution such as ammonium salts or as subtle a form as hand perspiration. If the rotor is not kept clean and chemicals remain on the rotor, corrosion will result. Also, any moisture left on the rotor for an extended period of time can initiate corrosion. Therefore, it is important the rotor is thoroughly dried after use.

In general, conditions for corrosion are present in all rotor applications; proper care and maintenance will minimize its effects.



**CAUTION** Always maintain the rotor in the recommended manner. The rotor and all accessories must be clean and inspected prior to each run. Do not use rotors that show signs of corrosion or cracking.



**CAUTION** Do not expose aluminum rotor components to: strong acids, bases, or alkaline laboratory detergents; liquid chlorine bleach; or salts (chlorides) or heavy metals such as cesium, lead, silver, or mercury. Use of these materials with aluminum can cause a chemical reaction that initiates corrosion.

## Cleaning and Decontamination

If the rotor or any of its parts have been exposed to a contaminant, they must be decontaminated before cleaning.



**WARNING** Always be aware of the possibility of contamination when using radioactive, toxic, or pathogenic materials. Take all necessary precautions to prevent exposure to such material. Use appropriate decontamination procedures if exposure occurs.

### Rotor Body

#### Cleaning

Wash the rotor body with warm water and mild soap or detergent at least once a week or, ideally, after each use. It is particularly important to wash the rotor immediately after any spills have occurred. Most laboratory chemicals can be removed with a lukewarm, 1 % solution of a mild, non-alkaline detergent such as a mild dishwashing liquid. Rinse the rotor well, inside and out. After rinsing, dry the rotor thoroughly with a soft absorbent cloth or an air blast. Apply a light film of vacuum grease to entire rotor surface.

Do not use strong laboratory detergents to clean the rotor surface. Use a bristle brush to loosen encrusted materials only if necessary; be careful not to scratch the rotor surface. If encrusted material is difficult to remove from the tube compartments and tapered hole on the bottom of the rotor, clean the rotor as follows:

- a. soak the rotor in a warm, neutral (pH7) cleaning solution (not containing chlorine) for 24 hours or more

OR

- b. soak the rotor in distilled water at a temperature between 70 °C to 80 °C. After all material is removed, rinse the rotor well with distilled water, then dry with an air blast. Apply a light film of vacuum grease to entire rotor surface.

#### Decontamination

Ethylene oxide, a 2 % glutaraldehyde solution, or ultraviolet radiation are the recommended methods of sterilization. The titanium rotor bodies can be autoclaved at temperatures up to 121 °C. Do not autoclave any of the aluminum rotor covers or the S45-A, S55-A, S58-A, S55-A2, S50-A, or S55-S aluminum rotor bodies. Aluminum must not be exposed to temperatures greater than 100 °C.

For general radioactive decontamination, use a solution of equal parts 70 % ethanol, 10 % SDS, and water. Follow this with ethanol rinses, then deionized water rinses. Dry with a soft absorbent cloth. Dispose of all wash solutions in radioactive waste containers.

## 6 Rotor Care and Maintenance

### Inspection

Dispose of all wash solutions in radioactive waste containers.



**CAUTION** Do not autoclave aluminum rotor components. If any of aluminum components are subjected to a temperature above 100 °C, they should not be used again. Also, do not use liquid chlorine bleach on the components, because it is very corrosive to aluminum.



**CAUTION** Most commercially available radioactive decontamination solutions are not compatible with aluminum or titanium.

### Rotor Cover Assembly

Wash the rotor cover assembly components with a mild detergent solution, rinse, then dry completely. Apply a thin film of vacuum grease to the cover O-rings before storing. If decontamination is required, use ethylene oxide or a 2 % glutaraldehyde solution.

Do not use liquid chlorine bleach to disinfect or sterilize the rotor cover.

Do not autoclave the rotor cover.

### Cover Opener

Wash the cover opener with warm tap water or diluent solution of pH 5-9 neutral detergent and dry completely. If decontamination is necessary, use ethylene oxide, formaldehyde or a 70% ethanol, 3% hydrogen peroxide, formalin.

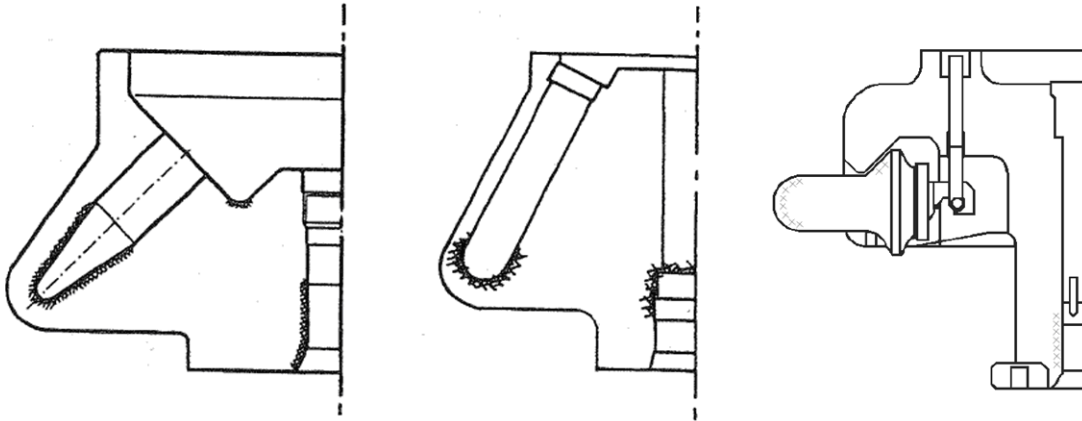
Do not autoclave the cover opener.

### Inspection

Inspect the rotor for corrosion at a minimum after every 100 hours of use. The critical areas to inspect are identified in figure 6-1. Look for discoloration, pitting, and cracks. If you find corrosion, do not use the rotor until it has been inspected by a Sorvall Field Service Engineer.



Inspect the rotor cover O-rings for cracks before each use and replace them if necessary.



**Figure 6-1** Corrosion Inspection Points for Fixed Angle and Swinging Bucket Rotors

## Storage

Rotors should be stored upside down, with covers removed, so air can circulate. This will help prevent moisture from gathering and settling at the bottom of the tube compartments.

## Service Decontamination

If a centrifuge or rotor that has been used with radioactive or pathogenic material requires servicing by Thermo Scientific personnel, either at the customer's laboratory or at a Thermo Scientific facility, comply with the following procedure to ensure the safety of all personnel:

Clean the micro-ultracentrifuge and/or rotor to be serviced of all encrusted material and decontaminate it (see Maintenance section of centrifuge or rotor instruction manual) prior to servicing by the Thermo Scientific representative or returning to the Thermo Scientific facility. There must be no radioactivity detectable by survey equipment.

The Thermo Scientific Product Guide contains descriptions of commonly used decontamination methods and a chart showing method compatibility with various materials. The centrifuge or rotor instruction manual contains specific guidance about cleaning and decontamination methods appropriate for the product it describes.

Clean and decontaminate your centrifuge or rotor as follows:

### For Micro-Ultracentrifuges:

- Remove rotor from the rotor chamber.
- Decontaminate door and rotor chamber using an appropriate method.

### For rotors:

Remove tubes, bottles, and adapters from the rotor and decontaminate rotor using an appropriate method. If tubes or rotor caps are stuck in the rotor, or the rotor lid is stuck, notify Thermo Scientific representative; be prepared with the name and nature of the sample so the Thermo Scientific Chemical Hazards Officer can decide whether to authorize the rotor's return to a Thermo Scientific facility.

Do not leave a loaded rotor locked inside a centrifuge that requires servicing. If, with a loaded rotor installed in the chamber, a centrifuge malfunction makes it so that the chamber door will not open by normal means, follow the Emergency Sample Recovery procedure found in your centrifuge operating instructions manual to gain access to the rotor.



**WARNING** Because of the characteristics of the samples likely to be processed in this rotor, biological or radioactive contamination may occur. Always be aware of this possibility and take the necessary precautions. Use appropriate decontamination procedures if exposure occurs.

Complete and attach Decontamination Information Certificate (in the back of your rotor or instrument manual) to the centrifuge or rotor before servicing.

Decontamination Information Certificates are included with this book. Additional certificates are available from the local Thermo Scientific Representative or Field Service Engineer. In the event these certificates are not available, a signed, written statement certifying that the unit has been properly decontaminated, identifying what the contaminants were and outlining the decontamination procedures used will be acceptable.

**Note** The Field Service Engineer will note on a Customer Service Repair Report if decontamination was required, and if so, what the contaminant was and what procedure was used. If no decontamination was required, it will be so stated.

If a centrifuge or rotor must be returned to be serviced does not have a Decontamination Information Certificate attached and, in Thermo Scientific's opinion presents a potential radioactive or biological hazard, the Thermo Scientific representative will not service the equipment until proper decontamination and certification is complete.

If the centrifuge or rotor must be returned to a Thermo Scientific facility:

Contact your Thermo Scientific representative to obtain an Equipment Return Decontamination Form; be prepared with the name and serial number of the centrifuge or rotor and the repairs required.

Complete the Equipment Return Decontamination Form and return it to Thermo Scientific. Upon a receipt of a completed form, a Returned Material Authorization Number (RMA Number) will be issued to you.

**Note** United States federal regulations require that parts and instruments must be decontaminated before being transported. Outside the United States, check local regulations.

If equipment is received at Thermo Scientific facilities without a valid RMA Number on the outside of the shipping container and a completed Equipment Return Decontamination Form on file, the equipment will be treated as a potential contamination hazard, and will not be serviced until decontamination certification has been completed. The sender will be contacted for instructions regarding disposition of the equipment in question; all disposition costs will be borne by the sender. If contaminated equipment is received at Thermo Scientific facilities, both the carrier and appropriate authorities shall be notified.

## **6 Rotor Care and Maintenance**

# Tubes, Bottles, and Accessories for Thermo Scientific Micro-Ultracentrifuge Rotors

This chapter provides information on Tubes, Bottles, and Accessories for Thermo Scientific Micro-Ultracentrifuge Rotors.

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## Micro-Ultracentrifuge Rotors

## Fiberlite F55-12x1.5 MUC



## ROTOR SPECIFICATIONS

<b>Type</b>	Fixed Angle	
<b>Material</b>	Carbon fiber composite	
<b>Capacity</b>	12 x 1.5 mL	
<b>Maximum Speed</b>	55,000 rpm	
<b>Maximum sample density</b>	1.2 g/mL	
<b>Tube Dimensions Ø x L</b>	11 x 40 mm	
<b>Angle</b>	45°	
<b>K-Factor</b>	45	
<b>Net Weight</b>	1.8 kg/4.0 lb	
<b>Warranty</b>	5 years	
	<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	221,575 x g	65.4 mm
<b>Minimum</b>	127,390 x g	37.6 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

Fiberlite F55-12x1.5 MUC Package (096-127033) includes:

Description	Cat. No.
1.5 mL polyallomer microtubes (1 pkg. of 100)	314352H01
O-ring refresher kit (3 O-rings)	021-127033
Lid fastening tool	014-2455
Rotor pad	097-1409
Lubricant	017-0055

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
1.5	1.5	High Performance Microtube	314352H01	100	12	55,000	221,575	11 x 40	-	-	-	-

## Micro-Ultracentrifuge Rotors

## Thermo Scientific S150-AT Rotor



## ROTOR SPECIFICATIONS

Type	Fixed Angle	
Material	Titanium	
Capacity	8 x 2.0 mL	
Maximum Speed	150,000 rpm	
Tube Dimensions Ø x L	11 x 34 mm	
Angle	30°	
K-Factor	6.1	
Net Weight	0.49 kg /1.1 lbs	
Warranty	5 years	
	<b>RCF</b>	<b>RADIUS</b>
Maximum	899,744 x g	35.8 mm
Average	711,250 xg	28.3 mm
Minimum	522,756 xg	20.8 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

## S150-AT Rotor Package includes:

Description	Cat. No.
S150-AT Rotor	45582
1.0 mL PC Thick-Walled Tubes (qty. 1 pkg. of 100)	45237
Large O-ring for Cover (qty. 2)	45702
Small O-ring for Cover (qty. 2)	45294
Rotor Holding Fixture	45266
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45735

## Accessories:

Description	Cat. No.
Starter Kit for use with Re-Seal Tubes (Includes 1 Crown (45306), 10 Plugs (45307), Wrench (45308) and Removal Tool (45309))	45305
11 mm x 32 mm Tube Vise	45537
11 mm x 25 mm Tube Vise	45536
Rotor Stand	45357
Cover Opener	45173

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
2.0	1.9	PA Re-Seal Tube	45246	50	8	150,000	899,744	11 x 32	Closure	45306	1	11 mm Noryl Crown <sup>1</sup>
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45537	1	Tube Vise
1.5	1.5	PA Re-Seal Tube	75000501	50	8	150,000	899,744	11 x 25	Closure	45306	1	11 mm Noryl Crown <sup>1</sup>
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45536	1	Tube Vise
1.5	1.5	PA Easy-Seal Tube	75000502	50	8	150,000	899,744	11 x 29	Closure	75000504	1	11 mm Al Crown <sup>1</sup>
									Tool	75000505	1	Crown Clamp
									Tool	75000506	1	Hex Driver
									Tool	75000507	1	Tube Removal Tool
									Tool	75000481	1	Easy-Seal Tube Vise
1.5	1.5	PET Easy-Seal Tube	75000503	50	8	120,000	575,836	11 x 29	Closure	75000504	1	11 mm Al Crown <sup>1</sup>
									Tool	75000505	1	Crown Clamp
									Tool	75000506	1	Hex Driver
									Tool	75000507	1	Tube Removal Tool
									Tool	75000481	1	Easy-Seal Tube Vise
1.0	1.0	PC Thick-Walled Tube	45237	100	8	150,000	899,744	11 x 34	-	-	-	-

<sup>1</sup> Must order one crown for each place in the rotor.



## Micro-Ultracentrifuge Rotors

## Thermo Scientific S140-AT Rotor



## ROTOR SPECIFICATIONS

<b>Type</b>	Fixed Angle	
<b>Material</b>	Titanium	
<b>Capacity</b>	10 x 2.0 mL	
<b>Maximum Speed</b>	140,000 rpm	
<b>Tube Dimensions Ø x L</b>	11 x 34 mm	
<b>Angle</b>	35°	
<b>K-Factor</b>	5.0	
<b>Net Weight</b>	0.8 kg /1.8 lbs	
<b>Warranty</b>	5 years	
	<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	1,048,684 x g	47.9 mm
<b>Minimum</b>	713,718 xg	32.6 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

## S140-AT Rotor Package includes:

Description	Cat. No.
S140-AT Rotor	45978
PC Thick-Walled Tubes Tube (qty. 1 pkg. of 100)	45237
Large O-ring for Cover	45986
Instruction Manual	45735
Rotor Holding Fixture	45266
Lubricant	61556
Vacuum Grease	65937

## Accessories:

Description	Cat. No.
Starter Kit for use with Re-Seal Tubes (Includes 10 Crown (45306), 10 Plugs (45307), Wrench (45308) and Removal Tool (45309))	45305
11 mm x 32 mm Tube Vise	45537
11 mm x 25 mm Tube Vise	45536
Rotor Stand	45357
Cover Opener	45173

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
2.0	1.9	PA Re-Seal Tube	45246	50	10	140,000	1,048,684	11 x 32	Closure	45306	1	11 mm Noryl Crown <sup>1</sup>
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45537	1	Tube Vise
1.5	1.5	PA Re-Seal Tube	75000501	50	10	140,000	1,048,684	11 x 25	Closure	45306	1	11 mm Noryl Crown <sup>1</sup>
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45536	1	Tube Vise
1.5	1.5	PA Easy-Seal Tube	75000502	50	10	140,000	1,048,684	11 x 29	Closure	75000504	1	11 mm Al Crown <sup>1</sup>
									Tool	75000505	1	Crown Clamp
									Tool	75000506	1	Hex Driver
									Tool	75000507	1	Tube Removal Tool
									Tool	75000481	1	Easy-Seal Tube Vise
1.5	1.5	PET Easy-Seal Tube	75000503	50	10	140,000	1,048,684	11 x 29	Closure	75000504	1	11 mm Al Crown <sup>1</sup>
									Tool	75000505	1	Crown Clamp
									Tool	75000506	1	Hex Driver
									Tool	75000507	1	Tube Removal Tool
									Tool	75000481	1	Easy-Seal Tube Vise
1.0	1.0	PC Thick-Walled Tubes	45237	100	10	140,000	1,048,684	11 x 34	-	-	-	-
1.0	1.0	PA Thick-Walled Tubes	45598	50	10	120,000	770,462	11 x 34	-	-	-	-

<sup>1</sup> Must order one crown for each place in the rotor.

## Micro-Ultracentrifuge Rotors

## Thermo Scientific S120-AT3 Rotor



## ROTOR SPECIFICATIONS

<b>Type</b>	Fixed Angle	
<b>Material</b>	Titanium	
<b>Capacity</b>	14 x 0.5 mL	
<b>Maximum Speed</b>	120,000 rpm	
<b>Tube Dimensions Ø x L</b>	8 x 34 mm	
<b>Angle</b>	30°	
<b>K-Factor</b>	7.8	
<b>Net Weight</b>	0.57 kg /1.3 lbs	
<b>Warranty</b>	5 years	
	<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	649,826 xg	40.4 mm
<b>Average</b>	534,015 xg	33.2 mm
<b>Minimum</b>	416,596 xg	25.9 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

## S120-AT3 Rotor Package includes:

Description	Cat. No.
S120-AT3 Rotor	45584
0.5 mL PC Thick-Walled Tubes (qty. 1 pkg. of 100)	45235
Large O-ring for Cover (qty. 2)	45532
Small O-ring for Cover (qty. 2)	45276
Rotor Holding Fixture	45266
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45735

## Accessories:

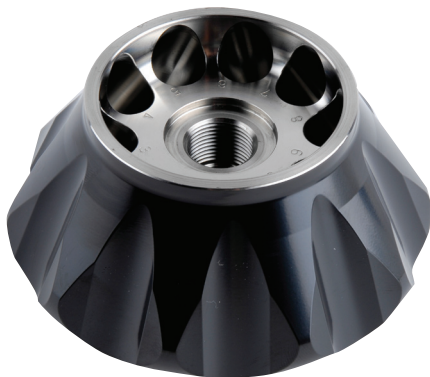
Description	Cat. No.
Rotor Stand	45357
Cover Opener	45173

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
0.5	0.5	PC Thick-Walled Tube	45235	100	14	120,000	649,826	8x 34	-	-	-	-
0.5	0.5	PA Thick-Walled Tube	45236	100	14	80,000	288,812	8x 34	-	-	-	-

## Micro-Ultracentrifuge Rotors

## Thermo Scientific S120-AT2 Rotor



## ROTOR SPECIFICATIONS

<b>Type</b>	Fixed Angle	
<b>Material</b>	Titanium	
<b>Capacity</b>	10 x 2.0 mL	
<b>Maximum Speed</b>	120,000 rpm	
<b>Tube Dimensions Ø x L</b>	11 x 34 mm	
<b>Angle</b>	30°	
<b>K-Factor</b>	8.2	
<b>Net Weight</b>	0.54 kg /1.2 lbs	
<b>Warranty</b>	5 years	
	<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	649,826 xg	40.4 mm
<b>Average</b>	529,190 xg	32.9 mm
<b>Minimum</b>	408,554 xg	25.4 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

## S120-AT2 Rotor Package includes:

Description	Cat. No.
S120-AT2 Rotor	45583
1.0 mL PC Thick-Walled Tubes (qty. 1 pkg. of 100)	45237
Large O-ring for Cover (qty. 2)	45532
Small O-ring for Cover (qty. 2)	45294
Rotor Holding Fixture	45266
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45735

## Accessories:

Description	Cat. No.
Starter Kit for use with Re-Seal Tubes (Includes 1 Crown (45306), 10 Plugs (45307), Wrench (45308) and Removal Tool (45309))	45305
11 mm x 32 mm Tube Vise	45537
11 mm x 25 mm Tube Vise	45536
Rotor Stand	45357
Cover Opener	45173

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
2.0	1.9	PA Re-Seal Tube	45246	50	10	120,000	649,826	11 x 32	Closure	45306	1	11 mm Noryl Crown <sup>1</sup>
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45537	1	Tube Vise
1.5	1.5	PA Re-Seal Tube	75000501	50	10	120,000	649,826	11 x 25	Closure	45306	1	11 mm Noryl Crown <sup>1</sup>
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45536	1	Tube Vise
1.5	1.5	PA Easy-Seal Tube	75000502	50	10	120,000	649,826	11 x 29	Closure	75000504	1	11 mm Al Crown <sup>1</sup>
									Tool	75000505	1	Crown Clamp
									Tool	75000506	1	Hex Driver
									Tool	75000507	1	Tube Removal Tool
									Tool	75000481	1	Easy-Seal Tube Vise
1.5	1.5	PET Easy-Seal Tube	75000503	50	10	140,000	649,826	11 x 29	Closure	75000504	1	11 mm Al Crown <sup>1</sup>
									Tool	75000505	1	Crown Clamp
									Tool	75000506	1	Hex Driver
									Tool	75000507	1	Tube Removal Tool
									Tool	75000481	1	Easy-Seal Tube Vise
1.0	1.0	PC Thick-Walled Tube	45237	100	10	120,000	649,826	11 x 34	-	-	-	-

<sup>1</sup> Must order one crown for each place in the rotor.

Micro-Ultracentrifuge Rotors

# Thermo Scientific S110-AT Rotor



## ROTOR SPECIFICATIONS

<b>Type</b>	Fixed Angle	
<b>Material</b>	Titanium	
<b>Capacity</b>	8 x 5.0 mL	
<b>Maximum Speed</b>	110,000 rpm	
<b>Tube Dimensions Ø x L</b>	13 x 63 mm	
<b>Angle</b>	30°	
<b>K-Factor</b>	15.4	
<b>Net Weight</b>	1.07 kg /2.4 lbs	
<b>Warranty</b>	5 years	
	<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	690,652 x g	51.1 mm
<b>Average</b>	510,893 xg	37.8 mm
<b>Minimum</b>	331,135 xg	24.5 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

### S110-AT Rotor Package includes:

Description	Cat. No.
S110-AT Rotor <sup>1</sup>	45539
4.0 mL PC Thick-Walled Tubes (qty. 2 pkg. of 50)	45239
Large O-ring for Cover (qty. 2)	45703
Small O-ring for Cover (qty. 2)	45294
Rotor Holding Fixture	45266
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45735

### Accessories:

Description	Cat. No.
Starter Kit for use with 13 mm Re-Seal Tubes (Includes 1 Crown (45321), 10 Plugs (45307), Wrench (45308) and Removal Tool (45309))	45320
13 mm x 51 mm Tube Vise	45534
Rotor Stand	45357
Cover Opener	45173

<sup>1</sup> Rotor compatible only with Thermo Scientific Sorvall MTX-150 and MX Series micro-ultracentrifuges.

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
5.0	5.1	PA Re-Seal Tube	45248	50	8	110,000	690,652	13 x 51	Closure	45321	1	13 mm Al Crown <sup>2</sup>
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45534	1	Tube Vise
5.0	5.0	PA Easy-Seal Tube	75000508	50	8	80,000	365,304	13 x 51	Closure	75000511	1	13 mm Al Crown <sup>2</sup>
									Closure	75000505	1	Crown Clamp
									Tool	75000506	1	Hex Driver
									Tool	75000507	1	Tube Removal Tool
									Tool	75000481	1	Easy-Seal Tube Vise
4.0	3.4	PC Thick-Walled Tube	45239	50	8	110,000	690,652	3 x 63	-	-	-	-
3.5	3.5	PA Easy-Seal Tube	75000509	50	8	80,000	365,304	13 x 45	Closure	75000511	1	13 mm Al Crown <sup>2</sup>
									Closure	75000505	1	Crown Clamp
									Tool	75000506	1	Hex Driver
									Tool	75000507	1	Tube Removal Tool
									Tool	75000481	1	Easy-Seal Tube Vise
3.5	3.5	PET Easy-Seal Tube	75000510	50	8	80,000	365,304	13 x 45	Closure	75000511	1	13 mm Al Crown <sup>2</sup>
									Closure	75000505	1	Crown Clamp
									Tool	75000506	1	Hex Driver
									Tool	75000507	1	Tube Removal Tool
									Tool	75000481	1	Easy-Seal Tube Vise
1.5	1.5	PA Easy-Seal Tube	75000512	50	8	80,000	365,304	13 x 29	Closure	75000511	1	13 mm Al Crown <sup>2</sup>
									Closure	75000505	1	Crown Clamp
									Tool	75000506	1	Hex Driver
									Tool	75000507	1	Tube Removal Tool
									Tool	75000481	1	Easy-Seal Tube Vise
1.5	1.5	High Performance Microtube	314352H01	100	8	55,000	172,663	11 x 42	Adapter	45587	1	Adapter for Microtube
1.5	-	Corning® Screw Cap Microtube <sup>3</sup>	-	-	8	110,000	582,000	-	Adapter	S412067	1	Adapter for Microtube

<sup>2</sup> Must order one crown for each place in the rotor.<sup>3</sup> Tubes must be purchased from manufacturer (cat. no. 430909).

Micro-Ultracentrifuge Rotors

# Thermo Scientific S100-AT4 Rotor



## ROTOR SPECIFICATIONS

<b>Type</b>	Fixed Angle	
<b>Material</b>	Titanium	
<b>Capacity</b>	6 x 3.5 mL	
<b>Maximum Speed</b>	100,000 rpm	
<b>Tube Dimensions Ø x L</b>	13 x 51 mm	
<b>Angle</b>	30°	
<b>K-Factor</b>	15.9	
<b>Net Weight</b>	1.07 kg /2.4 lbs	
<b>Warranty</b>	5 years	
	<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	540,628 x g	48.4 mm
<b>Average</b>	414,407 x g	37.1 mm
<b>Minimum</b>	288,186 x g	25.8 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

### S100-AT4 Rotor Package includes:

Description	Cat. No.
S100-AT4 Rotor	45586
3.0 mL PC Thick-Walled Tubes (qty. 2 pkg. of 50)	45238
Large O-ring for Cover (qty. 2)	45296
Small O-ring for Cover (qty. 2)	45294
Rotor Holding Fixture	45266
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45265

### Accessories:

Description	Cat. No.
Rotor Stand	45357
Cover Opener	45173



## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
3.2	3.2	PA Re-Seal Tube	45247	50	6	100,000	540,628	13 x 35	Closure	45318	1	13 mm Al Crown <sup>1</sup>
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45535	1	Tube Vise
3.5	3.5	PA Easy-Seal Tube	75000509	50	6	100,000	540,628	13 x 45	Closure	75000511	1	13 mm Al Crown <sup>1</sup>
									Tool	75000505	1	Crown Clamp
									Tool	75000506	1	Hex Driver
									Tool	75000507	1	Tube Removal Tool
									Tool	75000481	1	Easy-Seal Tube Vise
3.5	3.5	PET Easy-Seal Tube	75000510	50	6	80,000	346,002	13 x 45	Closure	75000511	1	13 mm Al Crown <sup>1</sup>
									Tool	75000505	1	Crown Clamp
									Tool	75000506	1	Hex Driver
									Tool	75000507	1	Tube Removal Tool
									Tool	75000481	1	Easy-Seal Tube Vise
3.0	2.7	PC Thick-Walled Tube	45238	50	6	100,000	540,628	13 x 51	-	-	-	-
2.0	1.9	PA Re-Seal Tube	75000513	50	6	100,000	540,628	13 x 25	Closure	45318	1	13 mm Al Crown <sup>1</sup>
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45535	1	Tube Vise
1.5	1.5	PA Easy-Seal Tube	75000512	50	6	80,000	346,002	13 x 29	Closure	75000511	1	13 mm Al Crown <sup>1</sup>
									Tool	75000505	1	Crown Clamp
									Tool	75000506	1	Hex Driver
									Tool	75000507	1	Tube Removal Tool
									Tool	75000481	1	Easy-Seal Tube Vise
1.5	1.5	High Performance Microtube	314352H01	100	6	55,000	163,540	13 x 42	Adapter	45587	1	Adapter for Microtube

<sup>1</sup> Must order one crown for each place in the rotor.

## Micro-Ultracentrifuge Rotors

## Thermo Scientific S100-AT3 Rotor



## ROTOR SPECIFICATIONS

<b>Type</b>	Fixed Angle	
<b>Material</b>	Titanium	
<b>Capacity</b>	20 x 0.2 mL	
<b>Maximum Speed</b>	100,000 rpm	
<b>Tube Dimensions Ø x L</b>	7 x 20 mm	
<b>Angle</b>	30°	
<b>K-Factor</b>	7.0	
<b>Net Weight</b>	0.52 kg /1.1 lbs	
<b>Warranty</b>	5 years	
	<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	435,630 xg	39.0 mm
<b>Average</b>	383,131 xg	34.3 mm
<b>Minimum</b>	330,632 xg	29.6 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

## S100-AT3 Rotor Package includes:

Description	Cat. No.
S100-AT3 Rotor	45585
0.2 mL PC Thick-Walled Tubes (qty. 1 pkg. of 100)	45233
Large O-ring for Cover (qty. 2)	45322
Small O-ring for Cover (qty. 2)	45276
Rotor Holding Fixture	45266
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45265

## Accessories:

Description	Cat. No.
Rotor Stand	45357
Cover Opener	45173

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
0.2	0.2	PC Thick-Walled Tube	45233	100	20	100,000	435,630	7 x 20	-	-	-	-
0.2	0.2	PA Thick-Walled Tube	45234	100	20	80,000	278,803	7 x 20	-	-	-	-

## Micro-Ultracentrifuge Rotors

## Thermo Scientific S80-AT3 Rotor



## ROTOR SPECIFICATIONS

<b>Type</b>	Fixed Angle	
<b>Material</b>	Titanium	
<b>Capacity</b>	8 x 8.3 mL	
<b>Maximum Speed</b>	80,000 rpm	
<b>Tube Dimensions Ø x L</b>	16 x 59 mm	
<b>Angle</b>	30°	
<b>K-Factor</b>	23.2	
<b>Net Weight</b>	1.6 kg /3.5 lbs	
<b>Warranty</b>	5 years	
	<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	414,630 xg	58.0 mm
<b>Average</b>	323,126 xg	45.2 mm
<b>Minimum</b>	230,906 xg	32.3 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

## S80-AT3 Rotor Package includes:

Description	Cat. No.
S80-AT3 Rotor	45590
6.0 mL PC Thick-Walled Tubes (qty. 2 pkg. of 50)	45595
Large O-ring for Cover (qty. 2)	45704
Small O-ring for Cover (qty. 2)	45294
Rotor Holding Fixture	45266
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45735

## Accessories:

Description	Cat. No.
Starter Kit for use with 16 mm Re-Seal Tubes {Includes 8 Crown (45599), 10 Plugs (45307), Wrench (45308) and Removal Tool (45309)}	45700
Re-Seal 16 mm x 53 mm Tube Vise	45701
Rotor Stand	45357
Cover Opener	45173

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
8.0	8.3	PA Re-Seal Tube	45597	50	8	80,000	414,630	16 x 53	Closure	45599	1	16 mm Al Crown <sup>1</sup>
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45701	1	Tube Vise
6.0	5.3	PC Thick-Walled Tube	45595	50	8	80,000	414,630	16 x 59	-	-	-	-
6.0	5.3	PA Thick-Walled Tube	45596	50	8	60,000	233,230	16 x 59	-	-	-	-

<sup>1</sup> Must order one crown for each place in the rotor.

## Micro-Ultracentrifuge Rotors

## Thermo Scientific S80-AT2 Rotor



## ROTOR SPECIFICATIONS

<b>Type</b>	Fixed Angle		
<b>Material</b>	Titanium		
<b>Capacity</b>	30 x 0.5 mL		
<b>Maximum Speed</b>	80,000 rpm		
<b>Tube Dimensions Ø x L</b>	8 x 34 mm		
<b>Angle</b>	30°		
<b>K-Factor</b>	Outer Row: 14 Inner Row: 16		
<b>Net Weight</b>	1.6 kg /3.5 lbs		
<b>Warranty</b>	5 years		
		<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	Outer Row	357,440 xg	50.0 mm
	Inner Row	303,824 xg	42.5 mm
<b>Minimum</b>	Outer Row	253,782 xg	35.5 mm
	Inner Row	200,881 xg	28.1 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

## S80-AT2 Rotor Package includes:

Description	Cat. No.
S80-AT2 Rotor	45589
PC Thick-Walled Tubes (qty. 1 pkg. of 100)	45235
Large O-ring for Cover (qty. 2)	S4040544
Small O-ring for Cover (qty. 2)	45294
Rotor Holding Fixture	45266
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45735

## Accessories:

Description	Cat. No.
Rotor Stand	45357
Cover Opener	45173

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
0.5	0.5	PC Thick-Walled Tube	45235	100	30	80,000	357,440	8x 34	-	-	-	-
0.5	0.5	PA Thick-Walled Tube	45236	100	30	80,000	357,440	8x 34	-	-	-	-

Micro-Ultracentrifuge Rotors

# Thermo Scientific S70-AT Rotor



### ROTOR SPECIFICATIONS

Type	Fixed Angle	
Material	Titanium	
Capacity	20 x 0.5 mL	
Maximum Speed	70,000 rpm	
Tube Dimensions Ø x L	7 x 56 mm	
Angle	30°	
K-Factor	30.7	
Net Weight	1.4 kg /3.1 lbs	
Warranty	5 years	
	<b>RCF</b>	<b>RADIUS</b>
Maximum	307,052 xg	56.1 mm
Average	238,636 xg	43.6 mm
Minimum	169,672 xg	31.0 mm

### ROTOR AND ACCESSORIES ORDERING INFORMATION

**S70-AT Rotor Package includes:**

Description	Cat. No.
S70-AT Rotor	45591
0.5 mL PC Thick-Walled Tubes (qty. 1 pkg. of 100)	45243
Large O-ring for Cover (qty. 2)	45297
Small O-ring for Cover (qty. 2)	45294
Rotor Holding Fixture	45266
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45735

**Accessories:**

Description	Cat. No.
Rotor Stand	45357
Cover Opener	45173

### LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
0.5	0.5	PC Thick-Walled Tube	45243	100	20	70,000	307,052	7 x 56	-	-	-	-

## Micro-Ultracentrifuge Rotors

## Thermo Scientific S58-A Rotor



## ROTOR SPECIFICATIONS

<b>Type</b>	Fixed Angle	
<b>Material</b>	Aluminum	
<b>Capacity</b>	8 x 13.5 mL	
<b>Maximum Speed</b>	58,000 rpm	
<b>Tube Dimensions Ø x L</b>	16 x 78 mm	
<b>Angle</b>	35°	
<b>K-Factor</b>	50.0	
<b>Net Weight</b>	1.9 kg/ 4.2 lbs	
<b>Warranty</b>	5 years	
	<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	288,959 xg	76.9 mm
<b>Average</b>	219,067 xg	58.3 mm
<b>Minimum</b>	148,800 xg	39.6 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

## S58-A Rotor Package includes:

Description	Cat. No.
S58-A Rotor <sup>1</sup>	45866
10.0 mL PC Thick-Walled Tubes (qty. 2 pkg. of 50)	03237
Large O-ring for Cover (qty. 2)	8062270
Small O-ring for Cover (qty. 2)	45999
Rotor Holding Fixture	45266
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45735

## Accessories:

Description	Cat. No.
Rotor Stand	45357
Cover Opener	45173
Ultracrimp/Clearcrimp Sealing Tool	03920
Crimp Gauge Replacement	03919

<sup>1</sup> Rotor compatible only with Thermo Scientific Sorvall MTX-150 and MX Series micro-ultracentrifuges. Use of this rotor in the Thermo Scientific Sorvall Discovery SE Series requires software upgrade S305612C and S305613C.

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
13.5	12.7	PA Re-Seal Tube	45809	50	8	58,000	288,959	16 x 85	Closure	45810	1	13 mm Al Crown <sup>2</sup>
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45534	1	Tube Vise
11.5	10.9	PA Ultracrimp Tube	03987	50	8	58,000	288,959	16 x 76	Closure	Included	50	Ultracrimp Plugs and caps
									Tool	03920	1	Ultracrimp Sealing Tool
10.0	9.1	PC Thick-Walled Tube <sup>3</sup>	03020	25	8	58,000	288,959	16 x 80	Closure	03613	25	PP Sealing Assembly
10.0	6.8	PP Thick-Walled Tube <sup>4</sup>	03929	50	8	45,000	173,942	16 x 80	Closure	03613	25	PP Sealing Assembly
10.0	6.8	PC Thick-Walled Tube	03237	50	8	58,000	288,959	16 x 71	-	-	-	-
10.0	6.8	PA Thick-Walled Tube	03238	50	8	27,500	64,960	16 x 71	-	-	-	-

<sup>2</sup> Must order one crown for each place in the rotor.<sup>3</sup> Rated to 50,000 rpm when partially filled.<sup>4</sup> Rated to 21,000 rpm when partially filled



## Micro-Ultracentrifuge Rotors

## Thermo Scientific S55-A2 Rotor



## ROTOR SPECIFICATIONS

Type	Fixed Angle	
Material	Aluminum	
Capacity	12 x 1.5 mL	
Maximum Speed	55,000 rpm	
Tube Dimensions Ø x L	11 x 42 mm	
Angle	45°	
K-Factor	39.8	
Net Weight	0.8 kg/1.8 lbs	
Warranty	5 years	
	<b>RCF</b>	<b>RADIUS</b>
Maximum	201,046 xg	59.5 mm
Average	163,202 xg	48.3 mm
Minimum	125,020 xg	37.0 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

## S55-A2 Rotor Package includes:

Description	Cat. No.
S55-A2 Rotor <sup>1</sup>	45865
1.5 mL High Performance Microtubes (qty. 1 pkg. of 100)	314352H01
Large O-ring for Cover (qty. 2)	45451
Small O-ring for Cover (qty. 2)	45294
Rotor Holding Fixture	45266
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45735

## Accessories:

Description	Cat. No.
Rotor Stand	45357
Cover Opener	45173

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
1.5	1.5	High Performance Microtube	314352H01	100	12	55,000	201,046	11 x 42	-	-	-	-

<sup>1</sup> Rotor compatible only with Thermo Scientific Sorvall MTX-150 and MX Series micro-ultracentrifuges. Use of this rotor in the Thermo Scientific Sorvall Discovery SE Series requires software upgrade S305612C and S305613C.

Micro-Ultracentrifuge Rotors

# Thermo Scientific S50-A Rotor



## ROTOR SPECIFICATIONS

<b>Type</b>	Fixed Angle	
<b>Material</b>	Aluminum	
<b>Capacity</b>	6 x 30 mL	
<b>Maximum Speed</b>	50,000 rpm	
<b>Tube Dimensions Ø x L</b>	26 x 96 mm	
<b>Angle</b>	35°	
<b>K-Factor</b>	60.7	
<b>Net Weight</b>	2.0 kg /4.4 lbs	
<b>Warranty</b>	5 years	
	<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	209,438 xg	75.0 mm
<b>Average</b>	162,244 xg	58.1 mm
<b>Minimum</b>	115,051 xg	41.2 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

### S50-A Rotor Package includes:

Description	Cat. No.
S50-A Rotor <sup>1</sup>	45540
25.0 mL PC Thick-Walled Tubes (qty. 2 pkg of 10)	75000610
Large O-ring for Cover (qty. 2)	8062014
Small O-ring for Cover (qty. 2)	8062285
Rotor Holding Fixture	45266
Rotor Stand	45357
Tweezers	452701
Tool Box (B)	320717
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45735

### Accessories:

Description	Cat. No.
Rotor Stand	45357
Cover Opener	45173

<sup>1</sup> Rotor compatible only with Thermo Scientific Sorvall MTX-150 and MX Series micro-ultracentrifuges.

S50-A

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
30.0	31.0	PA Re-Seal Tube	75000514	50	6	50,000	209,438	26 x 76	Closure	75000521	1	26 mm Al Crown <sup>1</sup>
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45534	1	Tube Vise
25.0	19.8	PC Thick-Walled Tube	75000610	10	6	50,000	209,438	26 x 96	-	-	-	-
25.0	19.8	PA Thick-Walled Tube	75000611	10	6	30,000	75,398	26 x 96	-	-	-	-
20.0	20.3	PC Bottle Assembly	75000612	6	6	50,000	209,438	26 x 80	-	-	-	-

<sup>1</sup> Must order one crown for each place in the rotor.

## Micro-Ultracentrifuge Rotors

## Thermo Scientific S55-S Rotor\*



## ROTOR SPECIFICATIONS

<b>Type</b>	Swinging Bucket	
<b>Material</b>	Aluminum	
<b>Capacity</b>	4 x 2.2 mL	
<b>Maximum Speed</b>	55,000 rpm	
<b>Tube Dimensions Ø x L</b>	11 x 34 mm	
<b>Angle</b>	180°	
<b>K-Factor</b>	43.8	
<b>Net Weight</b>	1.19 kg/2.6 lbs	
<b>Warranty</b>	5 years	
	<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	258,826 xg	76.6 mm
<b>Average</b>	206,114 xg	61.0 mm
<b>Minimum</b>	153,403 xg	45.4 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

## S55-S Rotor Package includes:

Description	Cat. No.
S55-S Rotor	45594
2.2 mL PA Thick-Walled Tubes (qty. 2 pkg. of 50)	45240
Bucket O-ring (qty. 8)	45276
Bucket Stand	45312
Bucket Cap Wrench	45277
Rotor Stand	45275
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45735

## Accessories:

Description	Cat. No.
Conical Adapter Removal Tool	75000480
Spare Buckets	45358

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
2.2	2.2	PC Thin-Walled Tube	45315	50	4	55,000	258,826	11 x 34	-	-	-	-
2.2	2.2	PC Ultrathin Tube	75000515	50	4	55,000	258,826	11 x 34	-	-	-	-
2.2	2.2	PA Thick-Walled Tube	45240	50	4	55,000	258,826	11 x 34	-	-	-	-
1.4	1.4	PC Ultracone Tube	75000516	50	4	55,000	258,826	11 x 32	-	75000470	1	Conical Adapter
									-	75000480	1	Conical Adapter Removal Tool
1.4	1.4	PA Ultracone Tube	75000517	50	4	55,000	258,826	11 x 32	-	75000470	1	Conical Adapter
									-	75000480	1	Conical Adapter Removal Tool
1.0	1.0	PC Thick-Walled Tube	45237	100	4	55,000	258,826	11 x 34	-	-	-	-

\* Use of this rotor in the Thermo Scientific Sorvall Discovery SE series requires a software update. For update, order Part No. S305612C and S305613C.

## Micro-Ultracentrifuge Rotors

## Thermo Scientific S52-ST Rotor



## ROTOR SPECIFICATIONS

<b>Type</b>	Swinging Bucket	
<b>Material</b>	Titanium	
<b>Capacity</b>	4 x 5.0 mL	
<b>Maximum Speed</b>	52,000 rpm	
<b>Tube Dimensions Ø x L</b>	13 x 51 mm	
<b>Angle</b>	180°	
<b>K-Factor</b>	78.6	
<b>Net Weight</b>	1.7 kg/ 3.7 lbs	
<b>Warranty</b>	5 years	
	<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	275,458 xg	91.2 mm
<b>Average</b>	197,230 xg	65.3 mm
<b>Minimum</b>	119,002 xg	39.4 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

## S52-ST Rotor Package includes:

Description	Cat. No.
S52-ST Rotor	45977
5.0 mL PA Thin-Walled Tube (qty. 1 pkg. of 50)	03127
Bucket O-ring (qty. 8)	45999
Bucket Stand	45312
Bucket Cap Wrench	45277
Rotor Stand	45275
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45735

## Accessories:

Description	Cat. No.
Crimp Gauge Replacement	03919
Noryl Replacement Floating Support Caps (qty. 6)	314358
Tube Removal Tool	12826
Cone-Top 13 mm x 32 mm Tube Vise	45537
Conical Adapter Removal Tool	75000480
Spare Buckets (qty. 4)	46107

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
5.0	5.0	PA Thin-Walled Tube	03127	50	4	52,000	275,458	13 x 51	-	-	-	-
5.0	5.0	PET Thin-Walled Tube	46101	50	4	52,000	275,458	13 x 51	-	-	-	-
3.5	3.5	PA Thick-Walled Tube	46102	50	4	52,000	275,458	13 x 51	-	-	-	-
3.4	3.4	PC Thick-Walled Tube	46100	50	4	52,000	275,458	13 x 51	-	-	-	-
3.5	3.4	PA Ultracone Tube	75000473	50	4	52,000	275,458	13 x 48	Adapter	75000468	1	Conical Adapter
									Tool	75000480	1	Conical Adapter Removal Tool
3.5	3.4	PET Ultracone Tube	75000519	50	4	52,000	275,458	13 x 48	Adapter	75000468	1	Conical Adapter
									Tool	75000480	1	Conical Adapter Removal Tool
3.5	3.1	PA Cone-Top Tube	75000456	50	4	52,000	275,458	13 x 32	Closure	75000457	1	13 mm Noryl Crown
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45537	1	Tube Vise
2.0	2.0	PA Cone-Top Tube	75000458	50	4	52,000	275,458	13 x 25	Closure	75000457	1	13 mm Noryl Crown
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45537	1	Tube Vise

## Micro-Ultracentrifuge Rotors

## Thermo Scientific S50-ST Rotor



## ROTOR SPECIFICATIONS

<b>Type</b>	Swinging Bucket	
<b>Material</b>	Titanium	
<b>Capacity</b>	4 x 7.0 mL	
<b>Maximum Speed</b>	50,000 rpm	
<b>Tube Dimensions Ø x L</b>	13 x 51 mm	
<b>Angle</b>	180°	
<b>K-Factor</b>	76.6	
<b>Net Weight</b>	1.8 kg/ 3.9 lbs	
<b>Warranty</b>	5 years	
	<b>RCF</b>	<b>RADIUS</b>
<b>Maximum</b>	252,721 xg	90.5 mm
<b>Average</b>	185,701 xg	66.5 mm
<b>Minimum</b>	118,681 xg	42.5 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

## S50-ST Rotor Package includes:

Description	Cat. No.
S50-ST Rotor	45541
PA Thin-Walled Tubes (qty. 1 pkg. of 50)	S309146C
Bucket O-ring (qty. 8)	8062220
Bucket Stand	45312
Bucket Cap Wrench	45277
Rotor Stand	45275
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45735

## Accessories:

Description	Cat. No.
Spare Buckets (qty. 4)	46107

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
7.0	7.0	PET Tube Assembly	S309168A	50	4	50,000	252,721	16 x 52	-	-	-	-
7.0	7.0	PA Tube Assembly	S309146C	50	4	50,000	252,721	16 x 52	-	-	-	-



## Micro-Ultracentrifuge Rotors

## Thermo Scientific S120-VT Rotor



## ROTOR SPECIFICATIONS

Type	Fixed Angle	
Material	Titanium	
Capacity	8 x 2.0 mL	
Maximum Speed	120,000 rpm	
Tube Dimensions Ø x L	11 x 32 mm	
Angle	0°	
K-Factor	7.9	
Net Weight	0.63 kg/1.4 lbs	
Warranty	5 years	
	<b>RCF</b>	<b>RADIUS</b>
Maximum	500,237 xg	31.1 mm
Average	410,162 xg	25.5 mm
Minimum	320,088 xg	19.9 mm

## ROTOR AND ACCESSORIES ORDERING INFORMATION

## S120-VT Rotor Package includes:

Description	Cat. No.
S120-VT Rotor	45593
PA Re-Seal Tubes (qty. 2 pkg. of 50)	45246
Crowns (qty. 1)	45310
Stainless Steel Plugs for Re-Seal tubes (qty. 1 pkg. of 10)	45307
Removal Tool	45309
Wrench	45308
Rotor Caps (qty. 8)	45311
Rotor Cap Wrench	45271
Rotor Holding Fixture	45446
Torque Wrench	45483
Lubricant	61556
Vacuum Grease	65937
Instruction Manual	45742

## Accessories:

Description	Cat. No.
Starter Kit for use with Re-Seal Tubes {Includes 10 Crowns (45306), 10 Plugs (45307), Wrench (45308) and Removal Tool (45309)}	45305
Tube Vise	45538
Tube Racks	06822
Ultracrimp Sealing Tool	03920
Replacement Plugs	03999

## LABWARE ORDERING INFORMATION

Tube Vol. (mL)	Vol. Fill (mL)	Description	Cat. No.	Qty. /Pkg.	Tubes /Rotor	Max. Speed (rpm)	Max. RCF <sup>2</sup> (x g)	Dims ØxL (mm)	REQUIRED TUBE CLOSURES, ADAPTERS, TOOLS & ACCESSORIES			
									Type	Cat. No.	Qty. /Pkg.	Description
2.0	1.9	PA Re-Seal Tube	45246	50	8	120,000	500,237	11 x 32	Closure	45306	1	11 mm Al Crown
									Closure	45307	10	Stainless Steel Plug
									Tool	45308	1	Wrench
									Tool	45309	1	Tube Removal Tool
									Tool	45537	1	Tube Vise
1.5	1.5	PA Ultracrimp Tube	06708	50	8	120,000	500,237	11 x 37	Closure	Included	50	Ultracrimp Plugs and caps
									Closure	06797	1	Rotor Cap
									Accessory	06822	1	Tube Racks
									Tool	03920	1	Ultracrimp Sealing tool

# Thermo Scientific Micro-Ultracentrifuge Rotor Warranty

## Micro-Ultracentrifuge Rotor Warranty

Thermo Scientific Sorvall micro-ultracentrifuge rotors are warranted, subject to the conditions specified below and in the warranty clause of the Thermo Fisher Scientific terms and conditions of sale in effect at the time of sale, against defects in materials or workmanship for five (5) years at any speed up to the maximum speed of the rotor (properly reduced for certain fluid densities, fluid gradients, tube assemblies, and adapters as described in these operating instructions).

### Conditions

- a. This warranty is valid for five (5) years from the date of shipment to the original buyer by Thermo Fisher Scientific or by any authorized Thermo Fisher Scientific representative.
- b. This warranty extends only to the original buyer and may not be assigned or extended to a third person without written consent of Thermo Fisher Scientific.
- c. This warranty covers the rotor only and Thermo Fisher Scientific shall not be liable for damage to accessories or ancillary supplies including but not limited to (i) tubes, (ii) tube caps, (iii) tube adapters, or (iv) tube contents.
- d. This warranty is void if the rotor is (i) operated or maintained in a manner contrary to the instructions in the manual for the rotor or centrifuge in use, or (ii) used in a Thermo Scientific Sorvall micro-ultracentrifuge that has been modified without the written permission of Thermo Fisher Scientific.
- e. Should a Thermo Scientific Sorvall micro-ultracentrifuge be damaged due to the failure of a rotor covered by this warranty, Thermo Fisher Scientific will supply free of charge, (i) all centrifuge parts required for repair and (ii) if the centrifuge is currently covered by a Thermo Fisher Scientific warranty or service agreement, all labor necessary for the repair of the centrifuge.

THE FOREGOING OBLIGATIONS ARE IN LIEU OF ALL OTHER OBLIGATIONS AND LIABILITIES INCLUDING NEGLIGENCE AND ALL WARRANTIES, OF MERCHANTABILITY OR OTHERWISE, EXPRESSED OR IMPLIED IN FACT OR BY LAW AND STATE OUR ENTIRE AND EXCLUSIVE LIABILITY AND BUYER'S EXCLUSIVE REMEDY FOR ANY CLAIM OR DAMAGES IN CONNECTION WITH THE SALE OR FURNISHING OF GOODS OR PARTS, THEIR DESIGN, SUITABILITY FOR USE, INSTALLATION OR OPERATION. THERMO FISHER SCIENTIFIC WILL IN NO EVENT BE LIABLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES WHATSOEVER, AND OUR LIABILITY UNDER NO CIRCUMSTANCES WILL EXCEED THE CONTRACT PRICE FOR THE GOODS FOR WHICH LIABILITY IS CLAIMED.

Terms may vary by country. Please contact your local sales office for further information.

# Chemical Compatibility Chart

CHEMICAL	MATERIAL	ALUMINUM	ANODIC COATING for ALUMINUM	BUNA N	CELLULOSE ACETATE BUTYRATE	POLYURETHANE ROTOR PAINT	COMPOSITE Carbon Fiber/Epoxy	DELRIN	ETHYLENE PROPYLENE	GLASS	NEOPRENE	NORYL	NYLON	PET <sup>1</sup> , POLYCLEAR, CLEARCRIMP	POLYALLOMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYETHERIMIDE	POLYRTHYLENE	POLYPROPYLENE	POLYSULFONE	POLYVINYL CHLORIDE	RULON A, TEFLON	SILICONE RUBBER	STAINLESS STEEL	TITANIUM	TYGON	VITON
2-mercaptoethanol	S	S	U	-	S	M	S	-	S	U	S	S	U	S	S	-	S	S	S	S	U	S	S	S	S	S	S	S
Acetaldehyde	S	-	U	U	-	-	-	M	-	U	-	-	-	M	U	U	U	M	M	-	M	S	U	-	S	-	U	
Acetone	M	S	U	U	S	U	M	S	S	U	U	S	U	S	U	U	U	S	S	U	U	S	M	M	S	U	U	
Acetonitrile	S	S	U	-	S	M	S	-	S	S	U	S	U	M	U	U	-	S	M	U	U	S	S	S	S	U	U	
Alconox	U	U	S	-	S	S	S	-	S	S	S	S	S	S	M	S	S	S	S	S	S	S	S	S	S	S	U	
Allyl Alcohol	-	-	-	U	-	-	S	-	-	-	-	S	-	S	S	M	S	S	S	-	M	S	-	-	S	-	-	
Aluminum Chloride	U	U	S	S	S	S	U	S	S	S	S	S	M	S	S	S	S	-	S	S	S	S	S	M	U	U	S	S
Formic Acid (100 %)	-	S	M	U	-	-	U	-	-	-	-	U	-	S	M	U	U	S	S	-	U	S	-	U	S	-	U	
Ammonium Acetate	S	S	U	-	S	S	S	-	S	S	S	S	S	S	S	U	-	S	S	S	S	S	S	S	S	S	S	S
Ammonium Carbonate	M	S	U	S	S	S	S	S	S	S	S	S	S	S	U	U	-	S	S	S	S	S	S	M	S	S	S	
Ammonium Hydroxide (10 %)	U	U	S	U	S	S	M	S	S	S	S	S	-	S	U	M	S	S	S	S	S	S	S	S	S	S	M	S
Ammoniumhydroxid (28 %)	U	U	S	U	S	U	M	S	S	S	S	S	U	S	U	M	S	S	S	S	S	S	S	S	S	S	M	S
Ammonium Hydroxide (conc.)	U	U	U	U	S	U	M	S	-	S	-	S	U	S	U	U	S	S	-	M	S	S	S	S	-	U		
Ammonium Phosphate	U	-	S	-	S	S	S	S	S	S	S	S	-	S	S	M	-	S	S	S	S	S	S	M	S	S	S	
Ammonium Sulfate	U	M	S	-	S	S	U	S	S	S	S	S	S	S	S	S	-	S	S	S	S	S	S	U	S	S	U	
Amyl Alcohol	S	-	M	U	-	-	S	S	-	M	-	S	-	M	S	S	S	S	M	-	-	-	U	-	S	-	M	
Aniline	S	S	U	U	S	U	S	M	S	U	U	U	U	U	U	U	-	S	M	U	U	S	S	S	S	U	S	
Sodium Hydroxide (<1 %)	U	-	M	S	S	S	-	-	S	M	S	S	-	S	M	M	S	S	S	S	S	S	M	S	S	-	U	
Sodium Hydroxide (10 %)	U	-	M	U	-	-	U	-	M	M	S	S	U	S	U	U	S	S	S	S	S	S	M	S	S	-	U	
Barium Salts	M	U	S	-	S	S	S	S	S	S	S	S	S	S	S	M	-	S	S	S	S	S	M	S	S	S	S	
Benzene	S	S	U	U	S	U	M	U	S	U	U	S	U	U	U	M	U	M	U	U	U	S	U	U	S	U	S	
Benzyl Alcohol	S	-	U	U	-	-	M	M	-	M	-	S	U	U	U	U	U	U	-	M	S	M	-	S	-	S		
Boric Acid	U	S	S	M	S	S	U	S	S	S	S	S	S	S	S	S	U	S	S	S	S	S	S	S	S	S	S	
Cesium Acetate	M	-	S	-	S	S	S	-	S	S	S	S	-	S	S	-	-	S	S	S	S	S	S	M	S	S	S	

CHEMICAL	MATERIAL																										
	ALUMINUM	ANODIC COATING for ALUMINUM	BUNA N	CELLULOSE ACETATE BUTYRATE	POLYURETHANE ROTOR PAINT	COMPOSITE Carbon Fiber/Epoxy	DELRIN	ETHYLENE PROPYLENE	GLASS	NEOPRENE	NORYL	NYLON	PET <sup>1</sup> , POLYCLEAR, CLEARCRIMP	POLYALLOMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYETHERIMIDE	POLYRTHYLENE	POLYPROPYLENE	POLYSULFONE	POLYVINYL CHLORIDE	RULON A, TEFLON	SILICONE RUBBER	STAINLESS STEEL	TITANIUM	TYGON	VITON
Cesium Bromide	M	S	S	-	S	S	S	-	S	S	S	S	S	S	S	-	-	S	S	S	S	S	S	M	S	S	S
Cesium Chloride	M	S	S	U	S	S	S	-	S	S	S	S	S	S	S	-	-	S	S	S	S	S	S	M	S	S	S
Cesium Formate	M	S	S	-	S	S	S	-	S	S	S	S	S	S	S	-	-	S	S	S	S	S	S	M	S	S	S
Cesium Iodide	M	S	S	-	S	S	S	-	S	S	S	S	S	S	S	-	-	S	S	S	S	S	S	M	S	S	S
Cesium Sulfate	M	S	S	-	S	S	S	-	S	S	S	S	S	S	S	-	-	S	S	S	S	S	S	M	S	S	S
Chloroform	U	U	U	U	S	S	M	U	S	U	U	M	U	M	U	U	U	M	M	U	U	S	U	U	U	M	S
Chromic Acid (10 %)	U	-	U	U	S	U	U	-	S	S	S	U	S	S	M	U	M	S	S	U	M	S	M	U	S	S	S
Chromic Acid (50 %)	U	-	U	U	-	U	U	-	-	-	S	U	U	S	M	U	M	S	S	U	M	S	-	U	M	-	S
Cresol Mixture	S	S	U	-	-	-	S	-	S	U	U	U	U	U	U	-	-	U	U	-	U	S	S	S	S	U	S
Cyclohexane	S	S	S	-	S	S	S	U	S	U	S	S	U	U	U	M	S	M	U	M	M	S	U	M	M	U	S
Deoxycholate	S	S	S	-	S	S	S	-	S	S	S	S	S	S	S	-	-	S	S	S	S	S	S	S	S	S	S
Distilled Water	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Dextran	M	S	S	S	S	S	S	-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	M	S	S	S
Diethyl Ether	S	S	U	U	S	S	S	U	S	U	U	S	U	U	U	U	U	U	U	U	U	S	S	S	S	M	U
Diethyl Ketone	S	-	U	U	-	-	M	-	S	U	-	S	-	M	U	U	U	M	M	-	U	S	-	-	S	U	U
Diethylpyrocarbonate	S	S	U	-	S	S	S	-	S	S	U	S	U	S	U	-	-	S	S	S	M	S	S	S	S	S	S
Dimethylsulfoxide	S	S	U	U	S	S	S	-	S	U	S	S	U	S	U	U	-	S	S	U	U	S	S	S	U	U	U
Dioxane	M	S	U	U	S	S	M	M	S	U	U	S	U	M	U	U	-	M	M	M	U	S	S	S	S	U	U
Ferric Chloride	U	U	S	-	-	-	M	S	-	M	-	S	-	S	-	-	-	S	S	-	-	-	M	U	S	-	S
Acetic Acid (Glacial)	S	S	U	U	S	S	U	M	S	U	S	U	U	U	U	U	M	S	U	M	U	S	U	U	S	-	U
Acetic Acid (5 %)	S	S	M	S	S	S	M	S	S	S	S	S	M	S	S	S	S	S	S	S	M	S	S	M	S	S	M
Acetic Acid (60 %)	S	S	U	U	S	S	U	-	S	M	S	U	U	M	U	S	M	S	M	S	M	S	M	U	S	M	U
Ethyl Acetate	M	M	U	U	S	S	M	M	S	S	U	S	U	M	U	U	-	S	S	U	U	S	M	M	S	U	U
Ethyl Alcohol (50 %)	S	S	S	S	S	S	M	S	S	S	S	S	U	S	U	S	S	S	S	S	S	S	S	M	S	M	U
Ethyl Alcohol (95 %)	S	S	S	U	S	S	M	S	S	S	S	S	U	S	U	-	S	S	S	M	S	S	S	U	S	M	U
Ethylene Dichloride	S	-	U	U	-	-	S	M	-	U	U	S	U	U	U	U	U	U	U	-	U	S	U	-	S	-	S
Ethylene Glycol	S	S	S	S	S	S	S	S	S	S	S	S	-	S	U	S	S	S	S	S	S	S	S	M	S	M	S
Ethylene Oxide Vapor	S	-	U	-	-	U	-	-	S	U	-	S	-	S	M	-	-	S	S	S	U	S	U	S	S	S	U
Ficoll-Hypaque	M	S	S	-	S	S	S	-	S	S	S	S	-	S	S	-	S	S	S	S	S	S	M	S	S	S	S
Hydrofluoric Acid (10 %)	U	U	U	M	-	-	U	-	-	U	U	S	-	S	M	U	S	S	S	S	M	S	U	U	U	-	-
Hydrofluoric Acid (50 %)	U	U	U	U	-	-	U	-	-	U	U	U	U	S	U	U	U	S	S	M	M	S	U	U	U	-	M

CHEMICAL	MATERIAL																										
	ALUMINUM	ANODIC COATING for ALUMINUM	BUNA N	CELLULOSE ACETATE BUTYRATE	POLYURETHANE ROTOR PAINT	COMPOSITE Carbon Fiber/Epoxy	DELRIN	ETHYLENE PROPYLENE	GLASS	NEOPRENE	NORYL	NYLON	PET <sup>1</sup> , POLYCLEAR, CLEARCRIMP	POLYALLOMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYETHERIMIDE	POLYRTHYLENE	POLYPROPYLENE	POLYSULFONE	POLYVINYL CHLORIDE	RULON A, TEFLON	SILICONE RUBBER	STAINLESS STEEL	TITANIUM	TYGON	VITON
Hydrofluoric Acid (conc.)	U	U	U	U	-	U	U	M	-	U	M	U	U	M	U	U	U	-	S	-	U	S	U	U	U	-	-
Formaldehyde (40 %)	M	M	M	S	S	S	S	M	S	S	S	S	M	S	S	S	U	S	S	M	S	S	S	M	S	M	U
Glutaraldehyde	S	S	S	S	-	-	S	-	S	S	S	S	S	S	-	-	S	S	S	-	-	S	S	S	S	-	-
Glycerol	M	S	S	-	S	S	S	S	S	S	S	S	S	S	S	S	-	S	S	S	S	S	S	S	S	S	S
Guanidine Hydrochloride	U	U	S	-	S	S	S	-	S	S	S	S	S	S	-	-	S	S	S	S	S	S	S	U	S	S	S
Haemo-Sol	S	S	S	-	-	-	S	-	S	S	S	S	S	S	-	-	S	S	S	S	S	S	S	S	S	S	S
Hexane	S	S	S	-	S	S	S	-	S	S	U	S	U	M	U	S	S	U	S	S	M	S	U	S	S	U	S
Isobutyl Alcohol	-	-	M	U	-	-	S	S	-	U	-	S	U	S	S	M	S	S	S	-	S	S	S	-	S	-	S
Isopropyl Alcohol	M	M	M	U	S	S	S	S	S	U	S	S	U	S	U	M	S	S	S	S	S	S	S	M	M	M	S
Iodoacetic Acid	S	S	M	-	S	S	S	-	S	M	S	S	M	S	S	-	M	S	S	S	S	S	M	S	S	M	M
Potassium Bromide	U	S	S	-	S	S	S	-	S	S	S	S	S	S	S	S	S	S	S	-	S	S	S	M	S	S	S
Potassium Carbonate	M	U	S	S	S	S	S	-	S	S	S	S	S	U	S	S	S	S	S	S	S	S	S	S	S	S	S
Potassium Chloride	U	S	S	-	S	S	S	S	S	S	S	S	S	S	-	S	S	S	S	S	S	S	S	U	S	S	S
Potassium Hydroxide (5 %)	U	U	S	S	S	S	M	-	S	S	S	S	-	S	U	S	S	S	S	S	S	S	M	U	M	S	U
Potassium Hydroxide (conc.)	U	U	M	U	-	-	M	-	M	S	S	-	U	M	U	U	U	S	M	-	M	U	-	U	U	-	U
Potassium Permanganate	S	S	S	-	S	S	S	-	S	S	S	U	S	S	M	-	S	M	S	U	S	S	M	S	U	S	S
Calcium Chloride	M	U	S	S	S	S	S	S	S	S	S	S	S	M	S	-	S	S	S	S	S	S	S	M	S	S	S
Calcium Hypochlorite	M	-	U	-	S	M	M	S	-	M	-	S	-	S	M	S	-	S	S	S	M	S	M	U	S	-	S
Kerosene	S	S	S	-	S	S	S	U	S	M	U	S	U	M	M	S	-	M	M	M	S	S	U	S	S	U	S
Sodium Chloride (10 %)	S	-	S	S	S	S	S	-	-	-	S	S	S	S	S	-	S	S	S	S	-	S	S	M	-	S	S
Iodoacetic Acid	U	-	S	U	S	S	S	-	-	-	-	S	S	S	S	-	S	S	-	S	-	S	S	M	-	S	S
Carbon Tetrachloride	U	U	M	S	S	U	M	U	S	U	U	S	U	M	U	S	S	M	M	S	M	M	M	M	U	S	S
Aqua Regia	U	-	U	U	-	-	U	-	-	-	-	-	U	U	U	U	U	U	-	-	-	-	-	-	S	-	M
Solution 555 (20 %)	S	S	S	-	-	-	S	-	S	S	S	S	S	S	-	-	S	S	S	-	S	S	S	S	S	S	S
Magnesium Chloride	M	S	S	-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	M	S	S	S
Mercaptoacetic Acid	U	S	U	-	S	M	S	-	S	M	S	U	U	U	U	-	S	U	U	S	M	S	U	S	S	S	S
Methyl Alcohol	S	S	S	U	S	S	M	S	S	S	S	S	U	S	U	M	S	S	S	S	S	S	S	M	S	M	U
Methylene Chloride	U	U	U	U	M	S	S	U	S	U	U	S	U	U	U	U	U	M	U	U	U	S	S	M	U	S	U
Methyl Ethyl Ketone	S	S	U	U	S	S	M	S	S	U	U	S	U	S	U	U	U	S	S	U	U	S	S	S	S	U	U
Metrizamide	M	S	S	-	S	S	S	-	S	S	S	S	-	S	S	-	-	S	S	S	S	S	S	M	S	S	S
Lactic Acid (100 %)	-	-	S	-	-	-	-	-	-	M	S	U	-	S	S	S	M	S	S	-	M	S	M	S	S	-	S

CHEMICAL	MATERIAL																										
	ALUMINUM	ANODIC COATING for ALUMINUM	BUNA N	CELLULOSE ACETATE BUTYRATE	POLYURETHANE ROTOR PAINT	COMPOSITE Carbon Fiber/Epoxy	DELRIN	ETHYLENE PROPYLENE	GLASS	NEOPRENE	NORYL	NYLON	PET <sup>1</sup> , POLYCLEAR, CLEARCRIMP	POLYALLOMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYETHERIMIDE	POLYRTHYLENE	POLYPROPYLENE	POLYSULFONE	POLYVINYL CHLORIDE	RULON A, TEFLON	SILICONE RUBBER	STAINLESS STEEL	TITANIUM	TYGON	VITON
Lactic Acid (20 %)	-	-	S	S	-	-	-	-	-	M	S	M	-	S	S	S	S	S	S	S	M	S	M	S	S	-	S
N-Butyl Alcohol	S	-	S	U	-	-	S	-	-	S	M	-	U	S	M	S	S	S	S	M	M	S	M	-	S	-	S
N-Butyl Phthalate	S	S	U	-	S	S	S	-	S	U	U	S	U	U	U	M	-	U	U	S	U	S	M	M	S	U	S
N, N-Dimethylformamide	S	S	S	U	S	M	S	-	S	S	U	S	U	S	U	U	-	S	S	U	U	S	M	S	S	S	U
Sodium Borate	M	S	S	S	S	S	S	S	S	S	S	U	S	S	S	S	-	S	S	S	S	S	S	M	S	S	S
Sodium Bromide	U	S	S	-	S	S	S	-	S	S	S	S	S	S	S	S	-	S	S	S	S	S	S	M	S	S	S
Sodium Carbonate (2 %)	M	U	S	S	S	S	S	S	S	S	S	S	S	S	U	S	S	S	S	S	S	S	S	S	S	S	S
Sodium Dodecyl Sulfate	S	S	S	-	S	S	S	-	S	S	S	S	S	S	S	-	S	S	S	S	S	S	S	S	S	S	S
Sodium Hypochlorite (5 %)	U	U	M	S	S	M	U	S	S	M	S	S	S	M	S	S	S	S	M	S	S	S	M	U	S	M	S
Sodium Iodide	M	S	S	-	S	S	S	-	S	S	S	S	S	S	S	-	-	S	S	S	S	S	S	M	S	S	S
Sodium Nitrate	S	S	S	-	S	S	S	S	S	S	S	S	S	S	S	S	-	S	S	S	S	S	U	S	S	S	S
Sodium Sulfate	U	S	S	-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	M	S	S	S
Sodium Sulfide	S	-	S	S	-	-	-	S	-	-	-	S	S	S	U	U	-	-	S	-	-	-	S	S	M	-	S
Sodium Sulfite	S	S	S	-	S	S	S	S	M	S	S	S	S	S	S	M	-	S	S	S	S	S	S	S	S	S	S
Nickel Salts	U	S	S	S	S	S	-	S	S	S	-	-	S	S	S	S	-	S	S	S	S	S	M	S	S	S	S
Oils (Petroleum)	S	S	S	-	-	-	S	U	S	S	S	S	U	U	M	S	M	U	U	S	S	S	U	S	S	S	S
Oils (Other)	S	-	S	-	-	-	S	M	S	S	S	S	U	S	S	S	S	U	S	S	S	S	-	S	S	M	S
Oleic Acid	S	-	U	S	S	S	U	U	S	U	S	S	M	S	S	S	S	S	S	S	S	S	M	U	S	M	M
Oxalic Acid	U	U	M	S	S	S	U	S	S	S	S	S	U	S	U	S	S	S	S	S	S	S	U	M	S	S	S
Perchloric Acid (10 %)	U	-	U	-	S	U	U	-	S	M	M	-	-	M	U	M	S	M	M	-	M	S	U	-	S	-	S
Perchloric Acid (70 %)	U	U	U	-	-	U	U	-	S	U	M	U	U	M	U	U	U	M	M	U	M	S	U	U	S	U	S
Phenol (5 %)	U	S	U	-	S	M	M	-	S	U	M	U	U	S	U	M	S	M	S	U	U	S	U	M	M	M	S
Phenol (50 %)	U	S	U	-	S	U	M	-	S	U	M	U	U	U	U	U	S	U	M	U	U	S	U	U	U	M	S
Phosphoric Acid (10 %)	U	U	M	S	S	S	U	S	S	S	S	U	-	S	S	S	S	S	S	S	S	S	U	M	U	S	S
Phosphoric Acid (conc.)	U	U	M	M	-	-	U	S	-	M	S	U	U	M	M	S	S	S	M	S	M	S	U	M	U	-	S
Physiologic Media (Serum, Urine)	M	S	S	S	-	-	S	-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Picric Acid	S	S	U	-	S	M	S	S	S	M	S	U	S	S	S	U	S	S	S	S	U	S	U	M	S	M	S
Pyridine (50 %)	U	S	U	U	S	U	U	-	U	S	S	U	U	M	U	U	-	U	S	M	U	S	S	U	U	U	U
Rubidium Bromide	M	S	S	-	S	S	S	-	S	S	S	S	S	S	S	-	-	S	S	S	S	S	S	M	S	S	S
Rubidium Chloride	M	S	S	-	S	S	S	-	S	S	S	S	S	S	S	-	-	S	S	S	S	S	S	M	S	S	S
Sucrose	M	S	S	-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S



CHEMICAL	MATERIAL																										
	ALUMINUM	ANODIC COATING for ALUMINUM	BUNA N	CELLULOSE ACETATE BUTYRATE	POLYURETHANE ROTOR PAINT	COMPOSITE Carbon Fiber/Epoxy	DELFIN	ETHYLENE PROPYLENE	GLASS	NEOPRENE	NORYL	NYLON	PET <sup>1</sup> , POLYCLEAR, CLEARCRIMP	POLYALLOMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYETHERIMIDE	POLYRTHYLENE	POLYPROPYLENE	POLYSULFONE	POLYVINYL CHLORIDE	RULON A, TEFLON	SILICONE RUBBER	STAINLESS STEEL	TITANIUM	TYGON	VITON
Sucrose, Alkaline	M	S	S	-	S	S	S	-	S	S	S	S	S	S	U	S	S	S	S	S	S	S	S	M	S	S	S
Sulfosalicylic Acid	U	U	S	S	S	S	S	-	S	S	S	U	S	S	S	-	S	S	S	-	S	S	S	U	S	S	S
Nitric Acid (10 %)	U	S	U	S	S	U	U	-	S	U	S	U	-	S	S	S	S	S	S	S	S	S	M	S	S	S	S
Nitric Acid (50 %)	U	S	U	M	S	U	U	-	S	U	S	U	U	M	M	U	M	M	M	S	S	S	U	S	S	M	S
Nitric Acid (95 %)	U	-	U	U	-	U	U	-	-	U	U	U	U	M	U	U	U	U	M	U	U	S	U	S	S	-	S
Hydrochloric Acid (10 %)	U	U	M	S	S	S	U	-	S	S	S	U	U	S	U	S	S	S	S	S	S	S	S	U	M	S	S
Hydrochloric Acid (50 %)	U	U	U	U	S	U	U	-	S	M	S	U	U	M	U	U	S	S	S	S	M	S	M	U	U	M	M
Sulfuric Acid (10 %)	M	U	U	S	S	U	U	-	S	S	M	U	S	S	S	S	S	S	S	S	S	S	U	U	U	S	S
Sulfuric Acid (50 %)	M	U	U	U	S	U	U	-	S	S	M	U	U	S	U	U	M	S	S	S	S	S	U	U	U	M	S
Schwefelsäure (konz.)	M	U	U	U	-	U	U	M	-	-	M	U	U	S	U	U	U	M	S	U	M	S	U	U	U	-	S
Stearic Acid	S	-	S	-	-	-	S	M	S	S	S	S	-	S	S	S	S	S	S	S	S	S	M	M	S	S	S
Tetrahydrofuran	S	S	U	U	S	U	U	M	S	U	U	S	U	U	U	-	M	U	U	U	U	S	U	S	S	U	U
Toluene	S	S	U	U	S	S	M	U	S	U	U	S	U	U	U	S	U	M	U	U	U	S	U	S	U	U	M
Trichloroacetic Acid	U	U	U	-	S	S	U	M	S	U	S	U	U	S	M	-	M	S	S	U	U	S	U	U	U	M	U
Trichloroethane	S	-	U	-	-	-	M	U	-	U	-	S	U	U	U	U	U	U	U	U	U	S	U	-	S	-	S
Trichloroethylene	-	-	U	U	-	-	-	U	-	U	-	S	U	U	U	U	U	U	U	U	U	S	U	-	U	-	S
Trisodium Phosphate	-	-	-	S	-	-	M	-	-	-	-	-	-	S	-	-	S	S	S	-	-	S	-	-	S	-	S
Tris Buffer (neutral pH)	U	S	S	S	S	S	S	-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Triton X-100	S	S	S	-	S	S	S	-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Urea	S	-	U	S	S	S	S	-	-	-	-	S	S	S	M	S	S	S	S	-	S	S	S	M	S	-	S
Hydrogen Peroxide (10 %)	U	U	M	S	S	U	U	-	S	S	S	U	S	S	S	M	U	S	S	S	S	S	S	M	S	U	S
Hydrogen Peroxide (3 %)	S	M	S	S	S	-	S	-	S	S	S	S	S	S	S	S	M	S	S	S	S	S	S	S	S	S	S
Xylene	S	S	U	S	S	S	M	U	S	U	U	U	U	U	U	M	U	M	U	U	U	S	U	M	S	U	S
Zinc Chloride	U	U	S	S	S	S	U	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	U	S	S	S
Zinc Sulfate	U	S	S	-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Citric Acid (10 %)	M	S	S	M	S	S	M	S	S	S	S	S	S	S	S	S	M	S	S	S	S	S	S	S	S	S	S

<sup>1</sup>Polyethyleneterephthalate

Key

- S Satisfactory
- M Moderate attack, may be satisfactory for use in centrifuge depending on length of exposure, speed involved, etc. Suggest testing under actual conditions of use.
- U Unsatisfactory, not recommended.
- Performance unknown; suggest testing, using sample to avoid loss of valuable material.

Chemical resistance data is included only as a guide to product use. No organized chemical resistance data exists for materials under the stress of centrifugation. When in doubt we recommend pretesting sample lots.

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