



Thermo Scientific

# A27-6x50 Rotor

for Sorvall LYNX Superspeed Centrifuges

## Instruction Manual

50138015-01

October 2012

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# Certificate of Containment Testing

## **Containment Testing of Rotor A27-6x50 in a Thermo Scientific Centrifuge**



**Report No. 170-12 D**

**Report Prepared For:** Thermo Fisher Scientific

**Issue Date:** 10<sup>th</sup> October 2012

### **Test Summary**

An A27-6x50 rotor was containment tested in a Thermo Scientific centrifuge at 27,000 rpm at partial vacuum, using Annex AA of IEC 1010-2-20:2006 (2<sup>nd</sup> Ed.). The sealed rotor was shown to contain all contents.

<b>Report Written By</b>  <b>Name: Ms Susan Macken</b> <b>Title: Biosafety Scientist</b>	<b>Report Authorised By</b>  <b>Name: Mrs Sara Speight</b> <b>Title: Senior Biosafety Scientist</b>
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## Preface

Before starting to use the rotor, read through this instruction manual carefully and follow the instructions.

The information contained in this instruction manual is the property of Thermo Fisher Scientific; it is forbidden to copy or pass on this information without explicit approval.

Failure to follow the instructions and safety information in this instruction manual will result in the expiration of the sellers warranty.

## Scope of Supply

Article Number		Quantity	Check
75003007	A27-6x50 Rotor	1	<input type="checkbox"/>
75003786	Grease for Threads	1	<input type="checkbox"/>
70009824	Anti-corrosion Oil	1	<input type="checkbox"/>
75007006	Replacement O-Rings with Vacuum Grease	1	<input type="checkbox"/>
65614	Retaining Ring Pliers	1	<input type="checkbox"/>
50136234	CD with Manual	1	<input type="checkbox"/>

If any parts are missing, please contact your nearest Thermo Fisher Scientific representative.



This symbol refers to general hazards.  
CAUTION means that material damage could occur.  
WARNING means that injuries or material damage or contamination could occur.



This symbol refers to biological hazards.  
Observe the information contained in the instruction manual to keep yourself and your environment safe.



This symbol means that the rotor and centrifuge manual contain additional important information.

Observe the information contained in the instruction manual to keep yourself and your environment safe.

## Precautions



### WARNING

In order to ensure safe operation of the A27-6x50 rotor, the following general safety regulations must be followed:

- Do not remove the magnet at the rotor bottom.
- Do not use rotors which show any signs of corrosion and/or cracks.
- Use only with rotors which have been loaded properly.
- Never overload the rotor.
- Use only accessories which have been approved by Thermo Fisher Scientific. Exceptions to this rule are commercially available glass or plastic centrifuge tubes, provided they have been approved for the speed or the RCF value of the rotor.
- Please observe the safety instructions.

Please pay particular attention to the following aspects:

- The rotor may be carried by the lid handle if the lid is properly tightened.
- Rotor installation: Check that the rotor is locked properly into place before operating the centrifuge.
- Always balance the samples.

Maximum sample density at maximum speed:  $1.2 \frac{g}{cm^3}$

# Rotor Information

## Contents

- “Rotor Data” on page 1
- “Rotor Package” on page 2
- “Rotor Accessory” on page 2
- “Information on Tubes and Bottles” on page 2

## Rotor Data

Centrifuge	Sorvall Lynx 6000	Sorvall Lynx 4000
Weight of empty Rotor [kg]	5.6	5.6
Max. Cycle Number	50000	50000
Maximum permissible Load [ g ]	6x75	6x75
Maximum Speed $n_{\max}$ [ rpm ]	27000	24000
Maximum RCF-Value at $n_{\max}$	79057	62465
K-Value at $n_{\max}$	485	
Radius max. / min. [ cm ]	9.7 / 2.4	9.7 / 2.4
Angle [ ° ]	34	34
Accel. / Braking Time [ s ]	pending	pending
Maximum Speed at 4°C [s]	25500	23500
Sample Cooling at $n_{\max}$ [°C] (Ambient Temperature of 23°C, Run Time 60 Minutes)	9	6
Aerosol-tight*	Yes	Yes
Maximum Autoclave Temperature (°C)	121	121

\* tested and approved by HPA, Porton-Down, UK



## Rotor Package

Description	Article Number
A27-6x50 Rotor	75003007
Grease for Threads	75003786
Anti-corrosion Oil	70009824
Replacement O-Rings with Vacuum Grease	75007006
Retaining Ring Pliers	65614
CD with Manual	50136234

## Rotor Accessory

Description	Article Number
Ultracrimp Sealing Tool and Crimp Gauge	03920
Ultracrimp Gauge Replacement	03919
Ultracrimp Extra Plugs and Caps	03999
Rotor Cap	03538
Rotor Stand	75003711

## Information on Tubes and Bottles

Description	Article Number	Type	Article Number	Description
PA Ultracrimp Tube	03528	Closure	Included	Plugs and Aluminum Caps
		Accessory	03538	Rotor Cap
		Accessory	03529	Tube Racks
		Accessory	03920	Sealing Tool
Nalgene PC Oak Ridge Tube	3138-0050	Closure	Included	PP Sealing
Nalgene PPCO Oak Ridge Tube	3139-0050	Closure	Included	PP Sealing
FEP Oak Ridge Tube	3114-0050	Closure	Included	FEP Screw Top
PP Flanged Tube	03147	Closure	03268	PP Snap-On
PC Flanged Tube	03146	Closure	03268	PP Snap-On
PA Flanged Tube	03139	—	—	—
SS Flanged Tube	00517	Closure	00518	SS Sealing
		Tool	01014	Wrench



Description	Article Number	Type	Article Number	Description
PC Oak Ridge Tube	314348	Closure	314347	Aluminum Sealing
		Adapter	00419	1 Place/Adapter
		Tool	314353	Tube Extractor Tool
PP Oak Ridge Tube	314349	Closure	314347	Aluminum Sealing
		Adapter	00419	1 Place/Adapter
		Tool	314353	Tube Extractor Tool
Glass Tube		Adapter	00368	Optional Caps
Nalgene PC Oak Ridge Tube	3138-16	Closure	Included	PA Sealing
		Adapter	00382	1 Place/Adapter
Nalgene PP Oak Ridge Tube	3139-16	Closure	Included	PA Sealing
		Adapter	00382	1 Place/Adapter
PP Flanged Tube	03244	Closure	03299	PP Snap-On
		Adapter	00382	1 place/adapt
PC Flanged Tube	03243	Closure	03269	PP Snap-On
		Adapter	00382	1 place/adapt
Glass Tube	—	Adapter	00363	1 Place/Adapter
GL Pyrex® Tube	03109	Adapter	00363	1 Place/Adapter
PP Flanged Tube	03116	Closure	03266	PP Nonsealing
		Adapter	00402	1 Place/Adapter
PC Flanged Tube	03115	Closure	03266	PP Nonsealing
		Adapter	00402	1 Place/Adapter
Nalgene PP Oak Ridge Tube	3139-10	Closure	Included	PA Sealing
		Adapter	00425	1 Place/Adapter
PP Oak Ridge Tube1	03929	Closure	03279	PP Sealing
		Adapter	00425	1 Place/Adapter
PC Oak Ridge Tube	03020	Closure	03279	PP Sealing
		Adapter	00425	1 Place/Adapter
Nalgene PC Oak Ridge Tube	3138-10	Closure	Included	PA Sealing
		Adapter	00425	1 Place/Adapter
PA Thin-Walled Tube	03124	Adapter	00473	2 Places/Adapter
PC Flanged Tube	03120	Closure	03265	PP Snap-On
		Adapter	00473	2 Places/Adapter
PP Flanged Tube	03121	Closure	03265	PP Snap-On
		Adapter	00473	2 Places/Adapter
PP Flanged Tube	03105	Closure	03264	PP Snap-On
		Adapter	00381	2 Places/Adapter
PP Flanged Tube	03104	Closure	03264	PP Snap-On

## 1 Rotor Information

Information on Tubes and Bottles

Description	Article Number	Type	Article Number	Description
		Adapter	00381	2 Places/Adapter
GL Pyrex Tube	03100	Adapter	00364	2 Places/Adapter
Conical Microtube	314352H01	Adapter	00381	2 Places/Adapter
Conical Microtube	—	Adapter	00381	2 Places/Adapter

# Thermo Scientific Auto-Lock Rotor Exchange

## Contents

- “Open and Close Rotor” on page 5
- “Rotor Installation” on page 5
- “Removing the Rotor” on page 6

## Open and Close Rotor

1. To tighten the lid, twist the lid handle clockwise until "hand tight". As a general rule, once the lid is tightend to the point of resistance, tighten an additional 1/4 turn.
2. To remove the lid, twist the lid handle counter clockwise until the lid can be removed from the rotor.

**Note** The rotor may be carried by the lid handle if the lid is properly tightened.

## Rotor Installation



**CAUTION** Unapproved or incorrectly combined accessories can cause serious damage to the centrifuge.

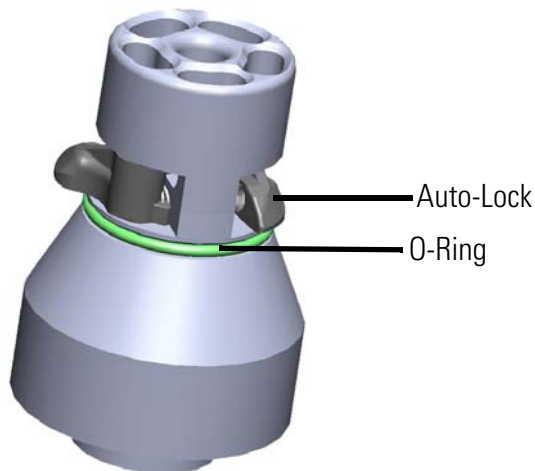
This rotor is equipped with Thermo Scientific Auto-Lock rotor exchange.

This system is used to automatically lock the rotor to the centrifuge spindle, eliminating the need to manually bolt the rotor to the centrifuge spindle.

Proceed as follows:

1. Open the door of the centrifuge and if necessary remove any dust, foreign objects or residue from the chamber.

Auto-Lock and o-ring must be clean and undamaged.



**Figure 2-1.** Auto-Lock

2. Place the rotor over the centrifuge spindle and let it slide slowly down the centrifuge spindle. The rotor clicks automatically into place.



**CAUTION** Do not force the rotor onto the centrifuge spindle. If the rotor is very light, then it may be necessary to press it onto the centrifuge spindle with a bit of pressure.

3. Check if the rotor is properly installed by lifting it slightly on the handle. If the rotor has not been locked, place the rotor over the centrifuge spindle again.



**WARNING** If the rotor cannot be properly locked in place after several attempts, then the Auto-Lock may be damaged and you are not permitted to operate the rotor. Check for any damage to the rotor: Damaged rotors must not be used. Keep the centrifuge spindle area of the rotor clear of objects. Operate the rotor always with the lid closed.



**CAUTION** Check that the rotor is properly locked on the centrifuge spindle before each use by pulling it at its handle.



**CAUTION** Be sure to check all sealings before starting any aerosol-tight applications.

4. Close the centrifuge door.

## Removing the Rotor

To remove the rotor, proceed as follows:

1. Open the centrifuge door.

2. Grab the rotor handle with one or both hands and push down on against the Auto-Lock button. At the same time, pull the rotor directly upwards and remove it from the centrifuge spindle. Make sure not to tilt the rotor while doing this.

**Note** The rotor lid must be properly tightened to the rotor body in order to remove the rotor from the centrifuge.



# Rotor Loading

## Contents

- “Before a Run” on page 9
- “Proper Loading” on page 9
- “Improper Loading” on page 10
- “Maximum Loading” on page 10
- “Lifetime” on page 10

## Before a Run

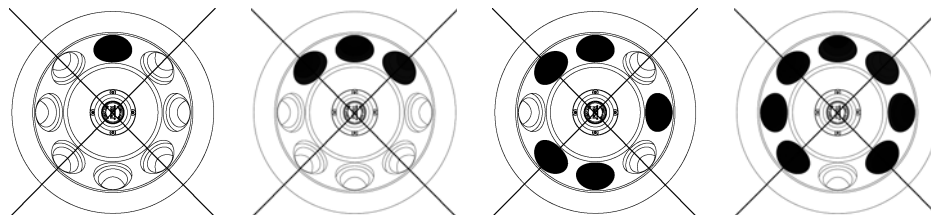
1. Please read and observe the safety instructions contained in these operating instructions and in the instructions for use.
2. Check the rotor and all accessory parts for damages such as cracks, scratches or traces of corrosion.
3. Check the rotor chamber, the centrifuge spindle and the Auto-Lock of the rotor.
4. Check the rotor’s suitability using the chemical compatibility chart on [page-35](#).

## Proper Loading



**Note** You can also fully load the rotor. It is very important that the tubes are balanced against each other.

## Improper Loading



## Maximum Loading

The rotor can run at high speeds. The rotor design has sufficient reserve stability even when spinning at top speed.

The safety system of the centrifuge requires that you do not overload the rotor.

There are two options available for centrifuging samples whose weight, including adapter, exceeds the maximum permissible load:

- Reduce the fill level.
- Reduce the speed.
- Calculate the maximum speed with this formula and set the centrifuge at the calculated maximum speed:

$$n_{\text{per}} = n_{\text{max}} \sqrt{\frac{\text{maximum permissible load}}{\text{actual load}}}$$

$n_{\text{per}}$  = Permissible Speed

$n_{\text{max}}$  = Maximum Speed

## Lifetime

The lifetime of rotors and buckets is dependent on the amount of mechanical load. Do not exceed the number of cycles recommended for rotors and buckets.

The maximum number of cycles for the rotor is given in the rotor table in section “Rotor Data” on [page 1](#).

The maximum number of cycles for buckets is marked on the buckets themselves.



**WARNING** Replace the rotor when the specified number of cycles is reached. Due to the mechanical load a rotor can break and thus damage the centrifuge.

### Service Life Examples

Usage profile	Maximum lifetime at 50,000 cycles
25 runs / day	10 years
200 days / year	



# Aerosol-tight Applications

## Contents

- “Basic Principles” on page 11
- “Fill Level” on page 11
- “Checking the Aerosol-Tightness” on page 11

## Basic Principles



**CAUTION** Aerosol-tight rotors and tubes may only be opened in an approved safety work-bench when centrifuging dangerous samples. Mind the maximum permissible load.



**CAUTION** Be sure to check all sealings before starting any aerosol-tight applications.

- Check that the sample containers are well suited for the desired centrifugation process.

## Fill Level

Open top tubes are only to be filled to a level which ensures that the sample is unable to reach the top of the tube during centrifugation. Therefore fill the tube only 2/3 of the rated level.

## Checking the Aerosol-Tightness

The aerosol tightness testing of the rotors and buckets depend on the microbiological test process in accordance with the EN 61010-2-020 Appendix AA.

Whether or not a rotor is aerosol-tight depends primarily on proper handling.

Check as needed to make sure your rotor is aerosol-tight.

The careful inspection of the seals and seal surfaces for signs of wear and damage such as cracks, scratches and embrittlement is extremely important.

Aerosol-tight applications are not possible if the rotor is run without the lid.

Aerosol-tightness requires the correct operation when filling the sample vessels and closing the rotor lid.

## Quick Test

As a quick test, it is possible to test the aerosol-tightness of fixed-angle rotors using the following process:

1. Lubricate all seals lightly.  
Always use the special grease 76003500 when lubricating the seals.
2. Fill the cavities with approx. 10 ml of carbonated mineral water.
3. Close the rotor as explained in the handling instructions.
4. Shake the rotor vigorously using your hands.  
This releases the carbonic acid gas which is bound in the water, resulting in excess pressure. Do not apply pressure to the lid when doing so.  
  
Leaks can be detected by escaping water or the sound of escaping gas.  
  
Replace the seals if you detect any leaks. Then repeat the test.
5. Dry the rotor, rotor lid and the cover seal.



**CAUTION** Prior to each use, the seals in the rotor are to be inspected in order to assure that they are correctly seated and are not worn or damaged.

## Maintenance and Care

### Contents

- “Cleaning Intervals” on page 13
- “Cleaning” on page 13
- “Disinfection” on page 16
- “Decontamination” on page 17
- “Autoclaving” on page 18
- “Service of Thermo Fisher Scientific” on page 18

## Cleaning Intervals

For the sake of personal, environmental, and material protection, it is your duty to clean and if necessary disinfect the rotor on a regular basis.

Maintenance	Recommended interval
Clean Rotor Chamber	Daily or when soiled
Clean Rotor	Daily or when soiled
Accessories	Daily or when soiled



**CAUTION** Refrain from using any other cleaning or decontamination procedure than those recommended here, if you are not entirely sure that the intended procedure is safe for the equipment.  
Use only approved cleansers.  
If in doubt, contact Thermo Fisher Scientific.

## Cleaning

Clean rotor and accessories as follows:

- Use warm water with a neutral solvent.
- Never use caustic cleaning agents such as soap suds, phosphoric acid, bleaching solutions or scrubbing powder.

- Rinse the cavities out thoroughly.
- Use a soft brush without metal bristles to remove stubborn residue.
- Afterwards rinse with distilled water.
- Place the rotors on a plastic grate with their cavities pointing down.
- If drying boxes are used, the temperature must never exceed 50°C, since higher temperatures could damage the material and shorten the lifetime of the parts.
- Use only disinfectants with a pH of 6-8.
- Dry aluminum parts off with a soft cloth.
- After cleaning, treat the entire surface of aluminum parts with corrosion protection oil (70009824). Also treat the rotor cavities with oil.
- Store the aluminum parts at room temperature or in a cold-storage room with the cavities pointing down.



**CAUTION** Before using any cleaning or decontamination methods except those recommended by the manufacturer, users should check with the manufacturer that the proposed method will not damage the equipment.

Clean rotor and accessories as follows:

1. Open the centrifuge.
  2. Turn off the centrifuge.
  3. Release the rotor.
  4. Grasp the rotor with both hands and lift it vertically off the centrifuge spindle.
  5. Remove the centrifuge tubes and adapters.
  6. Use a neutral cleaning agent with a pH value between 6 and 8 for cleaning.
  7. Dry all of the rotors and accessories after cleaning with a cloth or in a warm air cabinet at a maximum temperature of 50°C.
  8. Store the rotor with its lid open.
- After cleaning, treat the entire surface of aluminum parts with corrosion protection oil (70009824). Also treat the rotor cavities with oil.
  - Grease the seal (76003500).
  - Grease the thread in the lid (75003786).

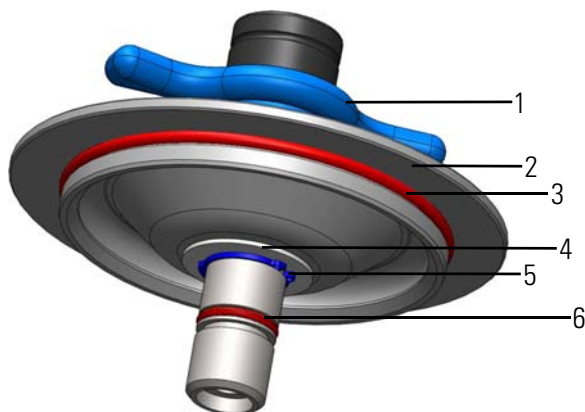


**CAUTION** When cleaning, do not allow liquids, especially organic solvents, to get on the drive shaft or the bearings of the centrifuge. Organic solvents break down the grease in the motor bearing. The drive shaft could freeze up.

## Maintenance of O-Rings in Rotor Lid

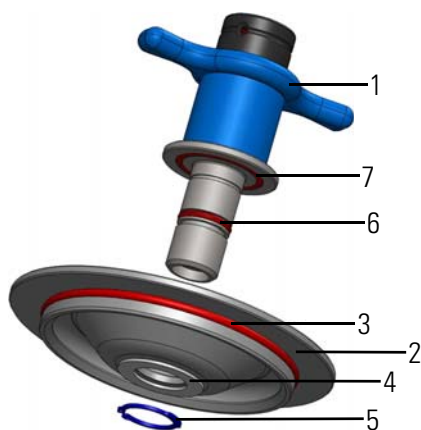
**Note** Check the O-ring when the rotor leaks and when autoclaving.

In order to maintain the O-rings (red in the drawings) you have to disassemble the rotor lid.



In order to reach O-rings you need a retaining ring plier (65614, shipped with rotor).

1. Hold the rotor lid with the lid knob (1) in your palm and the thread pointing upwards.
2. Insert the retaining ring plier (65614) in the eyes of the retaining ring (5).
3. Close the retaining ring plier (65614) and lift the retaining ring over the thread.



4. In order to remove the O-ring (6) in the threads push the O-ring on two opposing side so it will form a loop, which you then can use to remove the O-ring.

**Note** You can insert a paper-clip to the loop to lift the O-ring over the thread.



**CAUTION** Do not use any sharp items to remove the O-ring from the groove.

5. Control all the O-rings.



**CAUTION** O-rings that show signs of wear must be replaced.

6. Grease all the O-rings before inserting them again using the vacuum grease (76003500).
7. Place the O-rings back into their grooves.  
Use the staple again for O-ring (6).
8. Mount the rotor lid in reverse order.
9. Place the rotor plate (2) onto the thread.
10. Place the washer (4) onto the thread.
11. Hold the retaining ring (5) with the retaining ring plier (65614).
12. Open the retaining ring (5) and place it onto the thread until it has contact with the rotor plate (2).

## Disinfection

Disinfect the centrifuge immediately whenever infectious material has spilled during centrifugation.



**WARNING** Infectious material can get into the centrifuge when a tube breaks or as a result of spills. Keep in mind the risk of infection when touching the rotor and take all necessary precautions.  
In case of contamination, make sure that others are not put at risk.  
Decontaminate the affected parts immediately.  
Take other precautions if need be.

The rotor chamber and the rotor should be treated preferably with a neutral disinfectant.



**CAUTION** Before using any cleaning or decontamination methods except those recommended by the manufacturer, users should check with the manufacturer that the proposed method will not damage the equipment.  
Observe the safety precautions and handling instructions for the cleaning agents used.

Contact the Service Department of Thermo Fisher Scientific for questions regarding the use of other disinfectants.

Disinfect the rotor and accessories as follows:

1. Open the centrifuge.
2. Turn off the centrifuge.
3. Release the rotor.
4. Grasp the rotor with both hands and lift it vertically off the centrifuge spindle.
5. Remove the centrifuge tubes and adapters and dispose of them or disinfect them.

6. Treat the rotor and accessories according to the instructions for the disinfectant. Adhere strictly to the given application times.
7. Be sure the disinfectant can drain off the rotor.
8. Rinse the rotor and accessories thoroughly with water.
9. Dispose of the disinfectant according to the applicable guidelines.
10. Dry all of the rotors and accessories after cleaning with a cloth or in a warm air cabinet at a maximum temperature of 50°C.
11. Store the rotor with its lid open.
  - After cleaning, treat the entire surface of aluminum parts with corrosion protection oil (70009824). Also treat the rotor cavities with oil.
  - Grease the seal (76003500).
  - Grease the thread in the lid (75003786).

## Decontamination

Decontaminate the centrifuge immediately whenever radioactive material has spilled during centrifugation.



**WARNING** Radioactive material can get into the centrifuge when a tube breaks or as a result of spills. Keep in mind the risk of infection when touching the rotor and take all necessary precautions.  
In case of contamination, make sure that others are not put at risk.  
Decontaminate the affected parts immediately.  
Take other precautions if need be.



**CAUTION** Before using any cleaning or decontamination methods except those recommended by the manufacturer, users should check with the manufacturer that the proposed method will not damage the equipment.

For general radioactive decontamination use a solution of equal parts of 70% ethanol, 10% SDS and water.

1. Open the centrifuge.
2. Turn off the centrifuge.
3. Release the rotor.
4. Grasp the rotor with both hands and lift it vertically off the centrifuge spindle.
5. Remove the centrifuge tubes and adapters and dispose of them or disinfect them.
6. Rinse the rotor first with ethanol and then with de-ionized water.
  - Adhere strictly to the given application times.
7. Be sure the decontamination solution can drain off the rotor.
8. Rinse the rotor and accessories thoroughly with water.



9. Dispose of the decontamination solution according to the applicable guidelines.
10. Dry all of the rotors and accessories after cleaning with a cloth or in a warm air cabinet at a maximum temperature of 50°C.
11. Store the rotor with its lid open.
  - After cleaning, treat the entire surface of aluminum parts with corrosion protection oil (70009824). Also treat the rotor cavities with oil.
  - Grease the seal (76003500).
  - Grease the thread in the lid (75003786).

## Autoclaving

1. Before autoclaving clean rotor and accessories as described above.
2. Place the rotor on a flat surface.
  - Rotors and adapter can be autoclaved at 121°C.
  - The maximum permissible autoclave cycle is 20 minutes at 121°C.

**Note** No chemical additives are permitted in the steam.



**CAUTION** Never exceed the permitted temperature and duration when autoclaving. If the rotor shows signs of corrosion or wear, it must be replaced.

## Service of Thermo Fisher Scientific

Thermo Fisher Scientific recommends having the centrifuge and accessories serviced once a year by an authorized service technician. The service technician checks the following

- the electrical equipment
- the suitability of the set-up site
- the lid lock and the safety system
- the rotor
- the fixation of the rotor and the drive shaft

Thermo Fisher Scientific offers inspection and service contracts for this work. Any necessary repairs are performed for free during the warranty period and afterwards for a charge.

This is only valid if the centrifuge has only been maintained by a Thermo Fisher Scientific service technician.

## Shipping and Depositing of Centrifuge and Accessories

Contact the Thermo Scientific customer service before returning anything. You will receive a RMA that must be used for the shipping. When you have questions regarding the depositing the customer service will help you as well. The contact information can be found in “[Contact Information](#)” on [page 41](#).



**WARNING** Before shipping or depositing centrifuges and accessories you have to clean and if necessary disinfect or decontaminate everything. Before storing the centrifuge and the accessories it must be cleaned and if necessary disinfected and decontaminated.

## RCF-Values

Speed rpm	R <sub>min</sub>	R <sub>max</sub>	RCF R <sub>min</sub>	RCF R <sub>max</sub>
500	2.4	9.7	7	27
600	2.4	9.7	10	39
700	2.4	9.7	13	53
800	2.4	9.7	17	69
900	2.4	9.7	22	88
1000	2.4	9.7	27	108
1100	2.4	9.7	32	131
1200	2.4	9.7	39	156
1300	2.4	9.7	45	183
1400	2.4	9.7	53	213
1500	2.4	9.7	60	244
1600	2.4	9.7	69	278
1700	2.4	9.7	78	313
1800	2.4	9.7	87	351
1900	2.4	9.7	97	391
2000	2.4	9.7	107	434
2100	2.4	9.7	118	478
2200	2.4	9.7	130	525
2300	2.4	9.7	142	574
2400	2.4	9.7	155	625
2500	2.4	9.7	168	678
2600	2.4	9.7	181	733
2700	2.4	9.7	196	791
2800	2.4	9.7	210	850
2900	2.4	9.7	226	912
3000	2.4	9.7	241	976
3100	2.4	9.7	258	1042
3200	2.4	9.7	275	1110

Speed rpm	R <sub>min</sub>	R <sub>max</sub>	RCF R <sub>min</sub>	RCF R <sub>max</sub>
3300	2.4	9.7	292	1181
3400	2.4	9.7	310	1254
3500	2.4	9.7	329	1328
3600	2.4	9.7	348	1405
3700	2.4	9.7	367	1485
3800	2.4	9.7	387	1566
3900	2.4	9.7	408	1649
4000	2.4	9.7	429	1735
4100	2.4	9.7	451	1823
4200	2.4	9.7	473	1913
4300	2.4	9.7	496	2005
4400	2.4	9.7	519	2100
4500	2.4	9.7	543	2196
4600	2.4	9.7	568	2295
4700	2.4	9.7	593	2396
4800	2.4	9.7	618	2499
4900	2.4	9.7	644	2604
5000	2.4	9.7	671	2711
5100	2.4	9.7	698	2821
5200	2.4	9.7	726	2932
5300	2.4	9.7	754	3046
5400	2.4	9.7	782	3162
5500	2.4	9.7	812	3280
5600	2.4	9.7	841	3401
5700	2.4	9.7	872	3523
5800	2.4	9.7	903	3648
5900	2.4	9.7	934	3775
6000	2.4	9.7	966	3904
6100	2.4	9.7	998	4035
6200	2.4	9.7	1031	4169
6300	2.4	9.7	1065	4304
6400	2.4	9.7	1099	4442
6500	2.4	9.7	1134	4582
6600	2.4	9.7	1169	4724
6700	2.4	9.7	1204	4868
6800	2.4	9.7	1241	5015
6900	2.4	9.7	1277	5163

Speed rpm	R <sub>min</sub>	R <sub>max</sub>	RCF R <sub>min</sub>	RCF R <sub>max</sub>
7000	2.4	9.7	1315	5314
7100	2.4	9.7	1353	5467
7200	2.4	9.7	1391	5622
7300	2.4	9.7	1430	5779
7400	2.4	9.7	1469	5939
7500	2.4	9.7	1509	6100
7600	2.4	9.7	1550	6264
7700	2.4	9.7	1591	6430
7800	2.4	9.7	1632	6598
7900	2.4	9.7	1675	6768
8000	2.4	9.7	1717	6941
8100	2.4	9.7	1760	7115
8200	2.4	9.7	1804	7292
8300	2.4	9.7	1848	7471
8400	2.4	9.7	1893	7652
8500	2.4	9.7	1939	7835
8600	2.4	9.7	1984	8021
8700	2.4	9.7	2031	8208
8800	2.4	9.7	2078	8398
8900	2.4	9.7	2125	8590
9000	2.4	9.7	2173	8784
9100	2.4	9.7	2222	8980
9200	2.4	9.7	2271	9179
9300	2.4	9.7	2321	9379
9400	2.4	9.7	2371	9582
9500	2.4	9.7	2422	9787
9600	2.4	9.7	2473	9994
9700	2.4	9.7	2525	10204
9800	2.4	9.7	2577	10415
9900	2.4	9.7	2630	10629
10000	2.4	9.7	2683	10845
10100	2.4	9.7	2737	11063
10200	2.4	9.7	2792	11283
10300	2.4	9.7	2847	11505
10400	2.4	9.7	2902	11730
10500	2.4	9.7	2958	11956
10600	2.4	9.7	3015	12185

Speed rpm	R <sub>min</sub>	R <sub>max</sub>	RCF R <sub>min</sub>	RCF R <sub>max</sub>
10700	2.4	9.7	3072	12416
10800	2.4	9.7	3130	12649
10900	2.4	9.7	3188	12884
11000	2.4	9.7	3247	13122
11100	2.4	9.7	3306	13362
11200	2.4	9.7	3366	13603
11300	2.4	9.7	3426	13847
11400	2.4	9.7	3487	14094
11500	2.4	9.7	3549	14342
11600	2.4	9.7	3611	14592
11700	2.4	9.7	3673	14845
11800	2.4	9.7	3736	15100
11900	2.4	9.7	3800	15357
12000	2.4	9.7	3864	15616
12100	2.4	9.7	3928	15878
12200	2.4	9.7	3994	16141
12300	2.4	9.7	4059	16407
12400	2.4	9.7	4126	16675
12500	2.4	9.7	4193	16945
12600	2.4	9.7	4260	17217
12700	2.4	9.7	4328	17491
12800	2.4	9.7	4396	17768
12900	2.4	9.7	4465	18046
13000	2.4	9.7	4535	18327
13100	2.4	9.7	4605	18610
13200	2.4	9.7	4675	18896
13300	2.4	9.7	4746	19183
13400	2.4	9.7	4818	19473
13500	2.4	9.7	4890	19764
13600	2.4	9.7	4963	20058
13700	2.4	9.7	5036	20354
13800	2.4	9.7	5110	20652
13900	2.4	9.7	5184	20953
14000	2.4	9.7	5259	21255
14100	2.4	9.7	5334	21560
14200	2.4	9.7	5410	21867
14300	2.4	9.7	5487	22176

Speed rpm	R <sub>min</sub>	R <sub>max</sub>	RCF R <sub>min</sub>	RCF R <sub>max</sub>
14400	2.4	9.7	5564	22487
14500	2.4	9.7	5641	22801
14600	2.4	9.7	5720	23116
14700	2.4	9.7	5798	23434
14800	2.4	9.7	5877	23754
14900	2.4	9.7	5957	24076
15000	2.4	9.7	6037	24400
15100	2.4	9.7	6118	24727
15200	2.4	9.7	6199	25055
15300	2.4	9.7	6281	25386
15400	2.4	9.7	6363	25719
15500	2.4	9.7	6446	26054
15600	2.4	9.7	6530	26391
15700	2.4	9.7	6614	26731
15800	2.4	9.7	6698	27072
15900	2.4	9.7	6783	27416
16000	2.4	9.7	6869	27762
16100	2.4	9.7	6955	28110
16200	2.4	9.7	7042	28461
16300	2.4	9.7	7129	28813
16400	2.4	9.7	7217	29168
16500	2.4	9.7	7305	29524
16600	2.4	9.7	7394	29883
16700	2.4	9.7	7483	30245
16800	2.4	9.7	7573	30608
16900	2.4	9.7	7663	30973
17000	2.4	9.7	7754	31341
17100	2.4	9.7	7846	31711
17200	2.4	9.7	7938	32083
17300	2.4	9.7	8031	32457
17400	2.4	9.7	8124	32833
17500	2.4	9.7	8217	33212
17600	2.4	9.7	8311	33592
17700	2.4	9.7	8406	33975
17800	2.4	9.7	8501	34360
17900	2.4	9.7	8597	34747
18000	2.4	9.7	8694	35137



Speed rpm	R <sub>min</sub>	R <sub>max</sub>	RCF R <sub>min</sub>	RCF R <sub>max</sub>
18100	2.4	9.7	8790	35528
18200	2.4	9.7	8888	35922
18300	2.4	9.7	8986	36317
18400	2.4	9.7	9084	36715
18500	2.4	9.7	9183	37116
18600	2.4	9.7	9283	37518
18700	2.4	9.7	9383	37922
18800	2.4	9.7	9484	38329
18900	2.4	9.7	9585	38738
19000	2.4	9.7	9686	39149
19100	2.4	9.7	9789	39562
19200	2.4	9.7	9891	39978
19300	2.4	9.7	9995	40395
19400	2.4	9.7	10098	40815
19500	2.4	9.7	10203	41237
19600	2.4	9.7	10308	41661
19700	2.4	9.7	10413	42087
19800	2.4	9.7	10519	42515
19900	2.4	9.7	10626	42946
20000	2.4	9.7	10733	43378
20100	2.4	9.7	10840	43813
20200	2.4	9.7	10949	44250
20300	2.4	9.7	11057	44690
20400	2.4	9.7	11166	45131
20500	2.4	9.7	11276	45574
20600	2.4	9.7	11386	46020
20700	2.4	9.7	11497	46468
20800	2.4	9.7	11609	46918
20900	2.4	9.7	11720	47370
21000	2.4	9.7	11833	47825
21100	2.4	9.7	11946	48281
21200	2.4	9.7	12059	48740
21300	2.4	9.7	12173	49201
21400	2.4	9.7	12288	49664
21500	2.4	9.7	12403	50129
21600	2.4	9.7	12519	50597
21700	2.4	9.7	12635	51066

Speed rpm	R <sub>min</sub>	R <sub>max</sub>	RCF R <sub>min</sub>	RCF R <sub>max</sub>
21800	2.4	9.7	12752	51538
21900	2.4	9.7	12869	52012
22000	2.4	9.7	12987	52488
22100	2.4	9.7	13105	52966
22200	2.4	9.7	13224	53447
22300	2.4	9.7	13343	53929
22400	2.4	9.7	13463	54414
22500	2.4	9.7	13584	54901
22600	2.4	9.7	13705	55390
22700	2.4	9.7	13826	55881
22800	2.4	9.7	13948	56375
22900	2.4	9.7	14071	56870
23000	2.4	9.7	14194	57368
23100	2.4	9.7	14318	57868
23200	2.4	9.7	14442	58370
23300	2.4	9.7	14567	58874
23400	2.4	9.7	14692	59381
23500	2.4	9.7	14818	59889
23600	2.4	9.7	14944	60400
23700	2.4	9.7	15071	60913
23800	2.4	9.7	15199	61428
23900	2.4	9.7	15327	61945
24000	2.4	9.7	15455	62465
24100	2.4	9.7	15584	62987
24200	2.4	9.7	15714	63510
24300	2.4	9.7	15844	64036
24400	2.4	9.7	15975	64564
24500	2.4	9.7	16106	65095
24600	2.4	9.7	16238	65627
24700	2.4	9.7	16370	66162
24800	2.4	9.7	16503	66699
24900	2.4	9.7	16636	67238
25000	2.4	9.7	16770	67779
25100	2.4	9.7	16904	68322
25200	2.4	9.7	17039	68868
25300	2.4	9.7	17175	69415
25400	2.4	9.7	17311	69965

Speed rpm	R <sub>min</sub>	R <sub>max</sub>	RCF R <sub>min</sub>	RCF R <sub>max</sub>
25500	2.4	9.7	17448	70517
25600	2.4	9.7	17585	71071
25700	2.4	9.7	17722	71627
25800	2.4	9.7	17860	72186
25900	2.4	9.7	17999	72747
26000	2.4	9.7	18138	73309
26100	2.4	9.7	18278	73874
26200	2.4	9.7	18419	74442
26300	2.4	9.7	18559	75011
26400	2.4	9.7	18701	75583
26500	2.4	9.7	18843	76156
26600	2.4	9.7	18985	76732
26700	2.4	9.7	19128	77310
26800	2.4	9.7	19272	77890
26900	2.4	9.7	19416	78473
27000	2.4	9.7	19561	79057

## Rotor Care Guide

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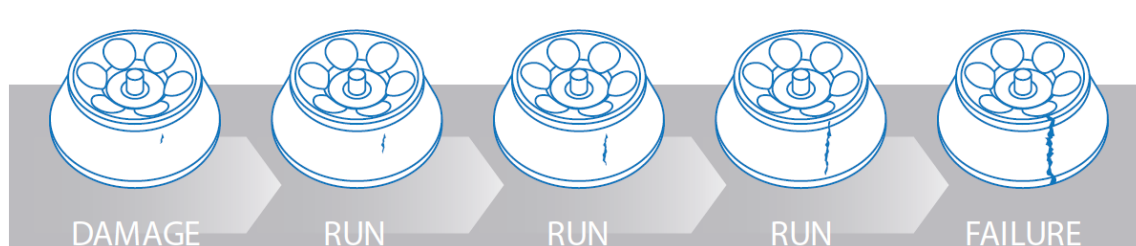
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Each time you use a rotor, visually inspect its condition for signs of physical wear or damage:

- Corrosion in the rotor cavities or exterior surfaces.
- Scratches or gouges to the base metal.
- Missing or worn anodizing.
- Damage to contact points, such as thread, hubs and screws.

Over time, stress observed in a typical fixed angle rotor will cause metal fatigue.

Heavy corrosion can result in premature rotor failure.



## Routine Evaluation and Care of Your Rotor

Rotors are frequently damaged in use and this damage may be exacerbated under centrifugal forces. As a result, even a tiny flaw in a critical part of the rotor may generate stresses greater than the rotor was designed to withstand. Rotors are also subject to high levels of stress due to the centrifugal force created by high rotational speeds, and repeated cycles can cause metal rotors to stretch and change in size.

### Proper Handling

Improper installation can lead to failure so it is imperative to:

- Always lock rotors to the spindle, if applicable.
- Ensure buckets are properly seated on their pins.
- Always use the tightening tool for locking and closing the rotor, if applicable.
- Use the proper rotor extractor tool to remove a rotor, if applicable.
- Avoid dropping or striking the rotor against a hard surface.
- Avoid putting anything inside the rotor that could scratch or nick the surface.

In addition, ensure that all tubes, bottles and adapters are being used within their specified limits and according to the manufacturer's directions. Tube or bottle failures during centrifugation can result in minor to severe damage to rotors and centrifuges.

### Stress Corrosion

Stress distribution is an important consideration when evaluating the extent of rotor damage. Ultraspeed rotors experience the highest level of stress of all rotors; if it is run above its rated speed, it probably has exceeded its yield point. In this event, the metal is permanently deformed and rotor life is severely compromised. Lower speed metal rotors will also become fatigued, depending on the rotor type, number of runs and the speed of those runs. However, corrosion, improper handling and misuse will often require that you retire your rotor long before normal fatigue becomes a danger.

### Missing Paint and Anodization

While missing paint will not affect the life of a titanium or carbon fiber rotor, missing anodization on an aluminum rotor may signal that it is time to retire the rotor.

### Dropped Rotors

Deformation caused by dropping a metal rotor cannot be repaired, requiring that the rotor be replaced. In some cases, carbon fiber rotors are repairable if damaged.

## Overheating

Melted bottles or other plastic or a rotor that is too hot to touch are indications that a rotor has overheated. Aluminum and carbon fiber rotors can be autoclaved up to 121°C, while titanium and stainless steel rotors can withstand higher temperatures and are not likely to be damaged by heat generated in the centrifuge.

## Rotor Maintenance

Protect your rotor against damage or failure with preventive measures and maintain maximum centrifuge performance. However, if rotor damage is observed, ensure the safety of your lab by taking recommended action or contacting your sales representative for an inspection.

Potential Damage	Preventive Measures	Recommended Action
Damage to lid assembly	<ul style="list-style-type: none"> <li>Lubricate periodically with a light film of o-ring or vacuum grease.</li> <li>Keep lid assembly lubricated with anti-galling grease</li> <li>Avoid banging or dropping</li> <li>Use care when removing o-rings.</li> <li>Clean with non-abrasive cloth and mild detergent.</li> </ul>	Return lid assembly parts to manufacturer for repair or replacement.
Damage to biocontainment sealing lid	<ul style="list-style-type: none"> <li>Use care when removing o-rings.</li> <li>Inspect and replace o-rings regularly.</li> </ul>	Replace sealing lid to ensure proper containment
Scoring to the bottom of the rotor (outside of cone area)	<ul style="list-style-type: none"> <li>Gently place rotor on the centrifuge spindle.</li> </ul> <p>Clean with non-abrasive cloth and mild detergent.</p> <ul style="list-style-type: none"> <li>Inspect centrifuge mated parts for burrs and ensure no debris in centrifuge chamber.</li> <li>Store rotor on rotor stand or soft surface.</li> </ul>	Return rotor to manufacturer for evaluation or replacement.
Damage to the rotor drive pins	<ul style="list-style-type: none"> <li>Gently place rotor on the centrifuge spindle.</li> <li>Ensure rotor is securely locked to centrifuge drive.</li> </ul>	Return rotor to manufacturer for replacement of rotor hub adapter or replace rotor depending on degree of damage/corrosion.
Pitting from corrosion in the bottom of tube cavity (metal rotors)	<ul style="list-style-type: none"> <li>Ensure rotor is dried thoroughly between runs.</li> <li>Clean rotor immediately after use and when exposed to chemicals with approved solvent.</li> <li>Remove adapters after use, rinse and dry.</li> </ul>	Return rotor to manufacturer for evaluation.
Cracked or de-laminated rotor	<ul style="list-style-type: none"> <li>Avoid sharp impact.</li> <li>Avoid harsh chemicals</li> <li>Clean the surface of rotor and coat with a thin layer of oil to prevent corrosion.</li> </ul>	Return rotor to manufacturer for evaluation.

Potential Damage	Preventive Measures	Recommended Action
Damage to rotor tie-down threads	<ul style="list-style-type: none"> <li>Avoid cross threading of parts.</li> <li>Never use metallic or abrasive objects to clean.</li> <li>Clean and lubricate regularly.</li> </ul>	Replace rotor tie-down assembly.
Damage to bucket seats	<ul style="list-style-type: none"> <li>Lubricate buckets regularly.</li> <li>Slide buckets into place carefully to avoid dropping or forcing into position.</li> </ul>	Replace rotor bucket set.
Windshield damage	<ul style="list-style-type: none"> <li>Avoid banging or dropping.</li> <li>Do not exceed rotor's maximum compartment mass.</li> <li>Ensure windshield area is free of debris.</li> </ul>	Replace rotor to avoid vibration that will wear the drive.
Rotor bucket cap damage	<ul style="list-style-type: none"> <li>Avoid cross threading of parts.</li> <li>Never use metallic objects to clean.</li> <li>Clean and lubricate regularly.</li> </ul>	Replace rotor bucket caps and return set for rebalancing (if applicable).
Rotor bucket damage	<ul style="list-style-type: none"> <li>Avoid banging or dropping</li> <li>Do not exceed rotor's maximum compartment mass.</li> <li>Ensure buckets are free of debris.</li> </ul>	Replace rotor buckets or return bucket set for rebalancing.
Gouges or corrosion on surface of rotor	<ul style="list-style-type: none"> <li>Inspect before every use.</li> </ul>	Return rotor to manufacturer for evaluation or replacement.
Septa damage in continuous flow or zonal rotor	<ul style="list-style-type: none"> <li>Avoid sharp impact.</li> <li>Avoid harsh chemicals</li> <li>Clean the surface of rotor and coat with a thin layer of oil to prevent corrosion.</li> </ul>	Return rotor to manufacturer for evaluation.
Light scratches on surface	<ul style="list-style-type: none"> <li>Avoid banging or dropping.</li> <li>Never use metallic objects to remove debris.</li> </ul>	Monitor to ensure no corrosion has occurred.
Bent centrifuge spindle	<ul style="list-style-type: none"> <li>Remove rotor in a straight up motion.</li> <li>Ensure samples are properly balanced</li> </ul>	Call service for replacement of centrifuge spindle

Corrosion, pitting and even minor surface imperfections affect metal rotor life by increasing stress and, as a result, make it difficult to predict at what point the rotor material could fail.

## Maintenance and Care

Metal corrosion can be avoided by following a routine maintenance program after each rotor use:

- Clean rotors, lids, adapters and any associated parts with a neutral cleaning agent with a pH value between 6 and 8. Rinse with distilled water and dry thoroughly with a soft cloth.
- Do not use strong alkaline laboratory detergent on aluminum rotors; if encrusted material is present, remove it with a soft, twisted-bristle brush and the 1% non-alkaline soap solution.
- For benchtop, lowspeed and superspeed swinging bucket rotors, keep the bucket trunnion pins clean and lubricated.



- Lubricate o-rings with vacuum grease and metal rotor threads with anti-galling grease (75003786) weekly, when specified in rotor manual.
- Apply an additional coating of anti-corrosion oil (70009824) to prolong the life of an anodized coating.
- Refer to the Maintenance and Care chapter in this rotor manual.

## Storage

Any moisture left on a metal rotor can initiate corrosion, so after cleaning ensure proper storage:

- Remove all adapters from rotor cavities when not in use.
- Dry and store upside-down Use a PTFE-coated or plastic matting to allow for airflow or a ventilated shelf to avoid gathering condensation in the cavity or bucket bottom.

## Decontamination

Given the nature of samples processed in a rotor, biological or radioactive contamination is possible. For biological contamination of rotors, a 2% glutaraldehyde solution, ethylene oxide or ultraviolet radiation are the recommended methods of sterilization, While for a rotor that may be contaminated by a radioactive sample, use a solution of equal parts of 70% ethanol, 10% SDS and water. In addition:

- Do not use chlorine bleach on aluminum rotors.
- When autoclaving, rotor components should be separated.
- If sterilization is not necessary, a 70% solution of ethanol can be used.
- Most commercially available detergents for radioisotopic contamination are not compatible with aluminum or anodized coatings and shall not be used.
- Rinse with ethanol, followed by water and dry with a soft cloth.
- Do not immerse Thermo Scientific Fiberlite rotors; spin rotor to remove liquid.
- Fiberlite composite rotors are not compatible with ethylene oxide.

# Chemical Compatibility Chart

CHEMICAL	MATERIAL	ALUMINUM	ANODIC COATING for ALUMINUM	BUNA N	CELLULOSE ACETATE BUTYRATE	POLYURETHANE ROTOR PAINT	COMPOSITE Carbon Fiber/Epoxy	DELRI <sup>®</sup>	ETHYLENE PROPYLENE	GLASS	NEOPRENE	NORYL	NYLON	PET <sup>1</sup> , POLYCLEAR, CLEARCRIMP	POLYALLUMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYETHERIMIDE	POLYETHYLENE	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
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	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
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	M	S
Ammonium Hydroxide (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	M	S
Ammonium Hydroxide (conc.)		U	U	U	U	S	U	M	S	-	S	-	S	U	S	U	U	S	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	S	M	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	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	DELFIN	ETHYLENE PROPYLENE	GLASS	NEOPRENE	NORLY	NYLON	PET <sup>1</sup> , POLYCLEAR, CLEARCRIMP	POLYALLUMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYTHERMIDE	POLYTHYLENE	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	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	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	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	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	S	M	S	S	S
Chloroform	U	U	U	U	S	S	M	U	S	U	U	M	U	M	U	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	S
Chromic Acid (50%)	U	-	U	U	-	U	U	-	-	-	S	U	U	S	M	U	M	S	S	U	M	S	-	U	M	-	S	S
Cresol Mixture	S	S	U	-	-	-	S	-	S	U	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	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	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	S
Dextran	M	S	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	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	U
Diethylpyrocarbonate	S	S	U	-	S	S	S	-	S	S	U	S	U	S	U	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	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	U
Ferric Chloride	U	U	S	-	-	-	M	S	-	M	-	S	-	S	-	-	-	S	S	-	-	-	M	U	S	-	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	U
Acetic Acid (5%)	S	S	M	S	S	S	M	S	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	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	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	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	U
Ethylene Dichloride	S	-	U	U	-	-	S	M	-	U	U	S	U	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	S
Ethylene Oxide Vapor	S	-	U	-	-	U	-	-	S	U	-	S	-	S	M	-	-	S	S	S	U	S	U	S	S	S	U	U
Ficoll-Hypaque	M	S	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	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	POLYTHIOMIDE	POLYETHYLENE	POLYPROPYLENE	POLYSULFONE	POLYVINYL CHLORIDE	RULON A, TEFLON	SILICONE RUBBER	STAINLESS STEEL	TITANIUM	TYGON	VITON
Hydrochloric 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	S	M	S	U	S	S	U
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	S	U	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	S	M	-	S	M	S	U	S	S	M	S	U	S
Calcium Chloride		M	U	S	S	S	S	S	S	S	S	S	S	S	S	M	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
Sodium Chloride (sat'd)		U	-	S	U	S	S	S	-	-	-	-	S	S	S	S	S	-	S	S	-	S	-	S	S	M	-	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	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

## C Chemical Compatibility Chart

CHEMICAL	MATERIAL	ALUMINUM	ANODIC COATING for ALUMINUM	BUNA N	CELLULOSE ACETATE BUTYRATE	POLYURETHANE ROTOR PAINT	COMPOSITE Carbon Fiber/Epoxy	DELRI <sup>®</sup>	ETHYLENE PROPYLENE	GLASS	NEOPRENE	NORLY	NYLON	PET <sup>1</sup> , POLYCLEAR, CLEARCRIMP	POLYALLUMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYTHERMIDE	POLYTHYLENE	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	S	M	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	S	U	M	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	DELIN	ETHYLENE PROPYLENE	GLASS	NEOPRENE	NORYL	NYLON	PET <sup>1</sup> , POLYCLEAR, CLEARCRIMP	POLYALLOMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYTHERMIDE	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	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	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	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	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	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	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	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	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	S	U	U	U	M	S	
Sulfuric Acid (conc.)	M	U	U	U	-	U	U	M	-	-	M	U	U	S	U	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	S	M	M	S	S	S	
Tetrahydrofuran	S	S	U	U	S	U	U	M	S	U	U	S	U	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	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	U	S	U	U	U	M	U	
Trichloroethane	S	-	U	-	-	-	M	U	-	U	-	S	U	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	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	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	S	
Urea	S	-	U	S	S	S	S	-	-	-	-	-	S	S	S	M	S	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	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	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	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	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	S	
Citric Acid (10%)	M	S	S	M	S	S	M	S	S	S	S	S	S	S	S	S	S	M	S	S	S	S	S	S	S	S	S	S	

\*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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