Thermo Scientific

A22-24x16 Rotor

for Sorvall LYNX Superspeed Centrifuges

Instruction Manual

50138025-01 October 2012

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Manufacturer

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Health Protection Agency
Microbiology Services
Porton Down
Salisbury
Wiltshire
SP4 0JG

Certificate of Containment Testing

Containment Testing of Rotor A22-24x16 in a Thermo Scientific Centrifuge

Report No. 170-12 A

Report Prepared For: Thermo Fisher Scientific

Issue Date: 10th October 2012

Test Summary

An A22-24x16 rotor was containment tested in a Thermo Scientific centrifuge at 22,000 rpm at partial vacuum, using Annex AA of IEC 1010-2-20:2006 (2nd Ed.). The sealed rotor was shown to contain all contents.

Report Written By	Report Authorised By
Name: Ms Susan Macken Title: Biosafety Scientist	Name: Mrs Sara Speight Title: Senior Biosafety Scientist

Table of Contents

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
75003005	A22-24x16 Rotor	1	☐
75003786	Grease for Threads	1	☐
70009824	Anti-corrosion Oil	1	☐
75003003	Replacement O-Rings with Vacuum Grease	1	☐
65614	Retaining Ring Pliers	1	☐
50136234	CD with Manual	1	☐

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 A22-24x16 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

Centrifuge	Sorvall Lynx 6000	Sorvall Lynx 4000
Weight of empty Rotor [kg]	7.6	7.6
Max. Cycle Number	50000	50000
Maximum permissible Load [g]	24x16	24x16
Maximum Speed n_{max} [rpm]	22000	22000
Maximum RCF-Value at n_{max}	60063	60063
Minimum RCF-Value at n_{max} inner Row	21103	21103
Minimum RCF-Value at n_{max} outer Row	29220	29220
K-Value at n_{max}	377	377
Radius max. / min. [cm] inner Row	11.1 / 3.9	11.1 / 3.9
Radius max. / min. [cm] outer Row	11.1 / 5.4	11.1 / 5.4
Angle [°] inner Row	28	28
Angle [°] outer Row	42	42
Accel. / Braking Time [s]	pending	pending
Maximum Speed at 4°C [s]	22000	19500
Sample Cooling at n_{max} [°C] (Ambient Temperature of 23°C, Run Time 60 Minutes)	<4	16
Aerosol-tight*	Yes	Yes
Maximum Autoclave Temperature (°C)	121	121

*Tested and approved by HPA, Porton-Down, UK

Rotor Package

Description	Article Number
A22-24x16 Rotor	75003005
Grease for Threads	75003786
Anti-corrosion Oil	70009824
Replacement O-Rings with Vacuum Grease	75003003
Retaining Ring Pliers	65614
CD with Manual	50136234

Rotor Accessory

Description	Article Number
Rotor Stand	75003711

Information on Tubes and Bottles

Description	Article Number	Type	Article Number	Description
PP Flanged Tube	03244	Closure	03299	PP Snap-on
PC Flanged Tube	03243	Closure	03269	PP Snap-on
Nalgene PC Oak Ridge Style Tube	3138 -0016	Closure	Included	PP Sealing
Nalgene PPCO Oak Ridge Style Tube	3139 -0016	Closure	Included	PP Sealing
PC Flanged Tube	03120	Closure	03265	PP Snap-on
		Adapter	00416	1 Place/Adapter
PP Flanged Tube	03121	Closure	03265	PP Snap-on
		Adapter	00416	1 Place/Adapter
Pyrex Tube	03102	Adapter	00376	1 Place/Adapter
Pyrex Tube	03100	Adapter	00374	1 Place/Adapter
Conical Microtube	314352H01	Adapter	00376	1 Place/Adapter

Thermo Scientific Auto-Lock Rotor Exchange

Contents

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.

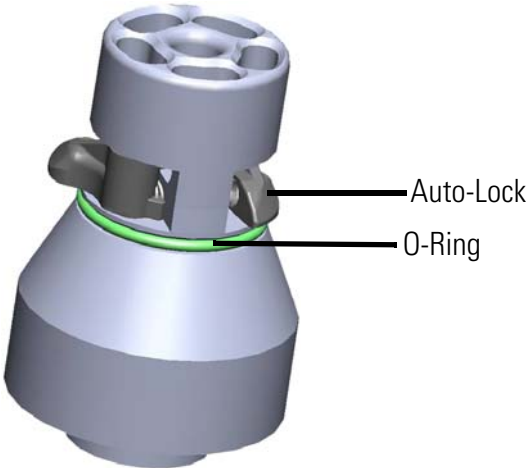


Figure 2-1. Auto-Lock

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

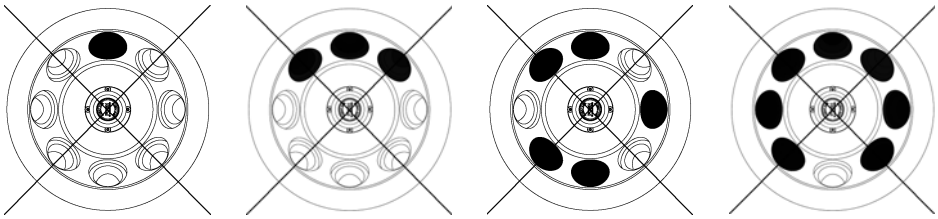
Before a Run

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 on page-33.

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:

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

n_{per} = Permissible Speed

n_{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 200 days / year	10 years

Aerosol-tight Applications

Contents

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

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.

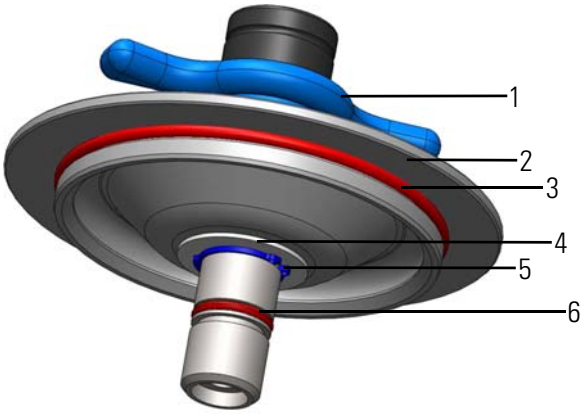
- After cleaning, treat the entire surface of aluminum parts with corrosion protection oil (70009824). Also treat the rotor cavities with oil.
- Grease the seal (76003500).
- Grease the thread in the lid (75003786).

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

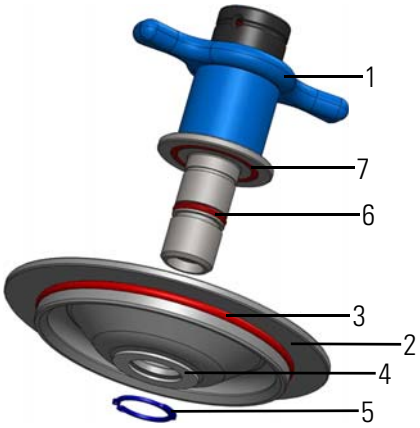
Note Check the O-ring when the rotor leaks and when autoclaving.

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 Deposing 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 deposing the customer service will help you as well. The contact information can be found in "Contact Information" on page 39.

WARNING Before shipping or deposing centrifuges and accessories you have ton cleanand 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_{min}	R_{max}	RCF R_{min}	RCF R_{max}
500	34	111	95	310
600	34	111	137	447
700	34	111	186	608
800	34	111	243	794
900	34	111	308	1005
1000	34	111	380	1241
1100	34	111	460	1502
1200	34	111	547	1787
1300	34	111	642	2097
1400	34	111	745	2432
1500	34	111	855	2792
1600	34	111	973	3177
1700	34	111	1099	3586
1800	34	111	1232	4021
1900	34	111	1372	4480
2000	34	111	1520	4964
2100	34	111	1676	5473
2200	34	111	1840	6006
2300	34	111	2011	6565
2400	34	111	2189	7148
2500	34	111	2376	7756
2600	34	111	2570	8389
2700	34	111	2771	9047
2800	34	111	2980	9729
2900	34	111	3197	10437
3000	34	111	3421	11169
3100	34	111	3653	11926
3200	34	111	3892	12708

Speed rpm	R_{min}	R_{max}	RCF R_{min}	RCF R_{max}
3300	34	111	4140	13514
3400	34	111	4394	14346
3500	34	111	4656	15202
3600	34	111	4926	16083
3700	34	111	5204	16989
3800	34	111	5489	17920
3900	34	111	5782	18875
4000	34	111	6082	19856
4100	34	111	6390	20861
4200	34	111	6705	21891
4300	34	111	7028	22946
4400	34	111	7359	24025
4500	34	111	7697	25130
4600	34	111	8043	26259
4700	34	111	8397	27413
4800	34	111	8758	28592
4900	34	111	9127	29796
5000	34	111	9503	31025
5100	34	111	9887	32278
5200	34	111	10278	33556
5300	34	111	10678	34859
5400	34	111	11084	36187
5500	34	111	11499	37540
5600	34	111	11921	38917
5700	34	111	12350	40319
5800	34	111	12787	41747
5900	34	111	13232	43199
6000	34	111	13684	44675
6100	34	111	14144	46177
6200	34	111	14612	47703
6300	34	111	15087	49254
6400	34	111	15570	50831
6500	34	111	16060	52431
6600	34	111	16558	54057
6700	34	111	17064	55708
6800	34	111	17577	57383
6900	34	111	18098	59083

Speed rpm	R_{min}	R_{max}	RCF R_{min}	RCF R_{max}
7000	34	111	18626	60808
7100	34	111	19162	62558
7200	34	111	19705	64332
7300	34	111	20257	66132
7400	34	111	20815	67956
7500	34	111	21382	69805
7600	34	111	21956	71679
7700	34	111	22537	73578
7800	34	111	23127	75501
7900	34	111	23723	77450
8000	34	111	24328	79423
8100	34	111	24940	81421
8200	34	111	25559	83443
8300	34	111	26186	85491
8400	34	111	26821	87564
8500	34	111	27464	89661
8600	34	111	28114	91783
8700	34	111	28771	93930
8800	34	111	29436	96101
8900	34	111	30109	98298
9000	34	111	30790	100519
9100	34	111	31478	102766
9200	34	111	32173	105037
9300	34	111	32877	107332
9400	34	111	33587	109653
9500	34	111	34306	111998
9600	34	111	35032	114369
9700	34	111	35765	116764
9800	34	111	36507	119184
9900	34	111	37256	121628
10000	34	111	38012	124098
10100	34	111	38776	126592
10200	34	111	39548	129112
10300	34	111	40327	131656
10400	34	111	41114	134224
10500	34	111	41908	136818
10600	34	111	42710	139437

Speed rpm	R_{min}	R_{max}	RCF R_{min}	RCF R_{max}
10700	34	111	43520	142080
10800	34	111	44337	144748
10900	34	111	45162	147441
11000	34	111	45995	150159
11100	34	111	46835	152901
11200	34	111	47682	155669
11300	34	111	48538	158461
11400	34	111	49400	161278
11500	34	111	50271	164120
11600	34	111	51149	166986
11700	34	111	52035	169878
11800	34	111	52928	172794
11900	34	111	53829	175735
12000	34	111	54737	178701
12100	34	111	55653	181692
12200	34	111	56577	184707
12300	34	111	57508	187748
12400	34	111	58447	190813
12500	34	111	59394	193903
12600	34	111	60348	197018
12700	34	111	61310	200158
12800	34	111	62279	203322
12900	34	111	63256	206511
13000	34	111	64240	209726
13100	34	111	65232	212965
13200	34	111	66232	216228
13300	34	111	67239	219517
13400	34	111	68254	222830
13500	34	111	69277	226169
13600	34	111	70307	229532
13700	34	111	71345	232920
13800	34	111	72390	236332
13900	34	111	73443	239770
14000	34	111	74504	243232
14100	34	111	75572	246719
14200	34	111	76647	250231
14300	34	111	77731	253768

Speed rpm	R_{min}	R_{max}	RCF R_{min}	RCF R_{max}
14400	34	111	78822	257330
14500	34	111	79920	260916
14600	34	111	81026	264527
14700	34	111	82140	268163
14800	34	111	83261	271824
14900	34	111	84390	275510
15000	34	111	85527	279221
15100	34	111	86671	282956
15200	34	111	87823	286716
15300	34	111	88982	290501
15400	34	111	90149	294311
15500	34	111	91324	298145
15600	34	111	92506	302005
15700	34	111	93696	305889
15800	34	111	94893	309798
15900	34	111	96098	313732
16000	34	111	97311	317691
16100	34	111	98531	321674
16200	34	111	99759	325683
16300	34	111	100994	329716
16400	34	111	102237	333774
16500	34	111	103488	337857
16600	34	111	104746	341964
16700	34	111	106012	346097
16800	34	111	107285	350254
16900	34	111	108566	354436
17000	34	111	109855	358643
17100	34	111	111151	362875
17200	34	111	112455	367132
17300	34	111	113766	371413
17400	34	111	115085	375719
17500	34	111	116412	380050
17600	34	111	117746	384406
17700	34	111	119088	388787
17800	34	111	120437	393192
17900	34	111	121794	397622
18000	34	111	123159	402078

Speed rpm	R_{min}	R_{max}	RCF R_{min}	RCF R_{max}
18100	34	111	124531	406557
18200	34	111	125911	411062
18300	34	111	127298	415592
18400	34	111	128693	420146
18500	34	111	130096	424725
18600	34	111	131506	429329
18700	34	111	132924	433958
18800	34	111	134350	438612
18900	34	111	135783	443290
19000	34	111	137223	447994
19100	34	111	138672	452722
19200	34	111	140127	457475
19300	34	111	141591	462253
19400	34	111	143062	467055
19500	34	111	144541	471883
19600	34	111	146027	476735
19700	34	111	147521	481612
19800	34	111	149022	486514
19900	34	111	150531	491440
20000	34	111	152048	496392
20100	34	111	153572	501368
20200	34	111	155104	506369
20300	34	111	156644	511395
20400	34	111	158191	516446
20500	34	111	159745	521522
20600	34	111	161308	526622
20700	34	111	162878	531748
20800	34	111	164455	536898
20900	34	111	166040	542072
21000	34	111	167633	547272
21100	34	111	169233	552497
21200	34	111	170841	557746
21300	34	111	172457	563020
21400	34	111	174080	568319
21500	34	111	175710	573643
21600	34	111	177349	578992
21700	34	111	178995	584365

Speed rpm	R_{min}	R_{max}	RCF R_{min}	RCF R_{max}
21800	34	111	180648	589763
21900	34	111	182309	595186
22000	34	111	183978	600634

Rotor Care Guide

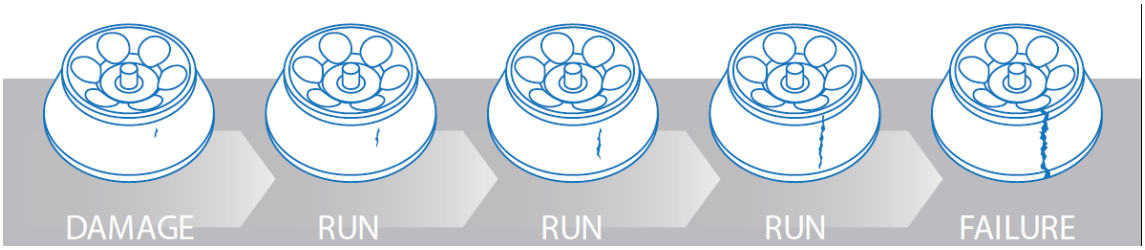
Contents

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 onan 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	• Lubricate periodically with a light film of o-ring or vacuum grease. • Keep lid assembly lubricated with anti-galling grease • Avoid banging or dropping • Use care when removing o-rings. • Clean with non-abrasive cloth and mild detergent.	Return lid assembly parts to manufacturer for repair or replacement.
Damage to biocontainment sealing lid	• Use care when removing o-rings. • Inspect and replace o-rings regularly.	Replace sealing lid to ensure proper containment
Scoring to the bottom of the rotor (outside of cone area)	• Gently place rotor on the centrifuge spindle. Clean with non-abrasive cloth and mild detergent. • Inspect centrifuge mated parts for burrs and ensure no debris in centrifuge chamber. • Store rotor on rotor stand or soft surface.	Return rotor to manufacturer for evaluation or replacement.
Damage to the rotor drive pins	• Gently place rotor on the centrifuge spindle. • Ensure rotor is securely locked to centrifuge drive.	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)	• Ensure rotor is dried thoroughly between runs. • Clean rotor immediately after use and when exposed to chemicals with approved solvent. • Remove adapters after use, rinse and dry.	Return rotor to manufacturer for evaluation.
Cracked or de-laminated rotor	• Avoid sharp impact. • Avoid harsh chemicals • Clean the surface of rotor and coat with a thin layer of oil to prevent corrosion.	Return rotor to manufacturer for evaluation.

Potential Damage	Preventive Measures	Recommended Action
Damage to rotor tie-down threads	• Avoid cross threading of parts. • Never use metallic or abrasive objects to clean. • Clean and lubricate regularly.	Replace rotor tie-down assembly.
Damage to bucket seats	• Lubricate buckets regularly. • Slide buckets into place carefully to avoid dropping or forcing into position.	Replace rotor bucket set.
Windshield damage	• Avoid banging or dropping. • Do not exceed rotor's maximum compartment mass. • Ensure windshield area is free of debris.	Replace rotor to avoid vibration that will wear the drive.
Rotor bucket cap damage	• Avoid cross threading of parts. • Never use metallic objects to clean. • Clean and lubricate regularly.	Replace rotor bucket caps and return set for rebalancing (if applicable).
Rotor bucket damage	• Avoid banging or dropping • Do not exceed rotor's maximum compartment mass. • Ensure buckets are free of debris.	Replace rotor buckets or return bucket set for rebalancing.
Gouges or corrosion on surface of rotor	• Inspect before every use.	Return rotor to manufacturer for evaluation or replacement.
Septa damage in continuous flow or zonal rotor	• Avoid sharp impact. • Avoid harsh chemicals • Clean the surface of rotor and coat with a thin layer of oil to prevent corrosion.	Return rotor to manufacturer for evaluation.
Light scratches on surface	• Avoid banging or dropping. • Never use metallic objects to remove debris.	Monitor to ensure no corrosion has occurred.
Bent centrifuge spindle	• Remove rotor in a straight up motion. • Ensure samples are properly balanced	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	DELRIN	ETHYLENE PROPYLENE	GLASS	NEOPRENE	NORYL	NYLON	PET[1], POLYCLEAR, CLEARCRIMP	POLYALLOMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYTHERMIDE	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
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	DELRIN	ETHYLENE PROPYLENE	GLASS	NEOPRENE	NORYL	NYLON	PET[1], POLYCLEAR, CLEARCRIMP	POLYALLOMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYTHERMIDE	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	S	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	S	M	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[1], POLYCLEAR, CLEARCRIMP	POLYALLOMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYTHERMIDE	POLYRTHYLENE	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	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	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	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

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[1], POLYCLEAR, CLEARCRIMP	POLYALLOMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYTHERMIDE	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	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	DELRIN	ETHYLENE PROPYLENE	GLASS	NEOPRENE	NORYL	NYLON	PET[1], 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	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
Sulfuric Acid (conc.)		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

[1]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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