Thermo Fisher Scientific

T-865

Instruction Manual

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For Research Use Only. Not for use in diagnostic procedures.

Table of contents

This manual is a guide for the use of

Thermo Scientific T-865 Fixed-Angle Ultracentrifuge Rotor

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

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

NOTES, CAUTIONS, and WARNINGS within the text of this manual are used to emphasize important and critical instructions.

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

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

NOTE highlights essential information.

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

Important Safety Information

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

WARNING

When using radioactive, toxic, or pathogenic materials, be aware of all characteristics of the materials and the hazards associated with them in the event leakage occurs during centrifugation. If leakage does occur, neither the centrifuge nor the rotor can protect you from particles dispersed in the air. To protect yourself, we recommend additional precautions be taken to prevent exposure to these materials, for example, use of controlled ventilation or isolation areas.

Always be aware of the possibility of contamination when using radioactive, toxic, or pathogenic materials. Take all necessary precautions and use appropriate decontamination procedures if exposure occurs.

Never use any material capable of producing flammable or explosive vapors or creating extreme exothermic reactions.

Never exceed the maximum rated speed of the installed rotor; to do so can cause rotor failure.

Always reduce (derate) rotor speed as instructed in this manual whenever:

- the rotor speed/temperature combination exceeds the solubility of the gradient material and causes it to precipitate.
- the compartment load exceeds the maximum allowable compartment load specified (average fluid density greater than 1.2 g/ml). See page 2-2.

Failure to reduce rotor speed under these conditions can cause rotor failure..

CAUTION

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

Do not operate or precool the rotor at the critical speed, as this will have a detrimental effect on centrifuge component life. See pages 2-2 and 2-3.

Operate the rotor only when it is symmetrically balanced as described in this manual. Operating the rotor out of balance can cause damage to the centrifuge drive assembly.

Rotors with covers must be operated with the cover in position and locked in place.

Always maintain the rotor in the recommended manner. The rotor and all accessories must be clean and inspected prior to each run: do not use rotors showing signs of corrosion or cracking. See Chapter 3, Care and Maintenance.

Do not autoclave the aluminum rotor cover or expose any aluminum rotor parts to temperatures in excess of 100°C.

DESCRIPTION

This manual contains information required to operate and maintain the Thermo Fisher Scientific T-865 Fixed-Angle Ultracentrifuge Rotor.. If you require additional information regarding operation or maintenance, please contact Thermo Fisher Scientific for assistance. In the United States, call Thermo Fisher Scientific toll-free 1-866-9THERMO; outside the United States, contact the nearest Thermo Fisher Scientific office (see back cover) or your local representative for Thermo Fisher Scientific products. Thermo Fisher Scientific product information is available on our internet web site at http:// www.thermo.com.

Contents

Rotor Description

The T-865 is an 8-place fixed-angle rotor that can be used at speeds up to 65 000 rpm.[1] The rotor body is machined from a titanium forging for strength and corrosion resistance. The aluminum lid and locking nut are given a blue anodized finish for surface protection.The rotor is tightly sealed during operation by two O-rings - one that fits inside the rotor lid and another around the bottom of the locking nut. The eight tube compartments are bored at a 23.5° angle to the axis of rotation. A disc with alternative black and reflective segments on the bottom of the rotor provides overspeed protection.

Rotor Specifications

Table 1-1. Rotor Specifications

Rotor Type	Fixed Angle
Maximum Speed	65 000 rpm*
Relative Centrifugal Force (RCF) at Maximum Speed:	
at $r_{minimum}$ (9.10 cm)	429 459
at $r_{average}$ (6.47 cm)	305 340
at $r_{maximum}$ (3.84 cm)	181 222
K Factor at Maximum Speed	51.7
Critical Speed	1200 rpm
Tube Size (Maximum)	25 mm x 97 mm
Capacity per Tube Compartment (Nominal)	36 ml
Number of Tube Compartment	8
Total Rotor Capacity	288 ml
Maximum Tube Compartment Mass	66 g
Tube Angle	23.5°
Rotor Diameter	19.5 cm (7.75 inch)
Rotor Weight (empty)	8.3 kg (18.3 lb)

* With tubes filled with a homogenous solution having an average density of 1.2 g/ml or less.

Accessories

a. Accessories Supplied

The accessories supplied with the T-865 Rotor, Catalog No. 54305 (rotor and complete accessories), are listed in Table 1-1. Those items indicated by an asterisk (*) are not supplied with Catalog No. 51411, which is a T-865 with basic accessories only.

[1] Speed in revolutions per minute (rpm) is related to angular velocity, ω, according to the following:

$$\omega = (\text{rpm})\left(\frac{2\pi}{60}\right) = (\text{rpm})(0.10472)$$

Where ω = rad/s. All further references to speed in this manual will be designated as rpm.

Note In order to seal the ULTRACRIMP® tubes (supplied with Catalog No. 54305) you must have an ULTRACRIMP® Sealing Tool, Catalog No. 03920.

To order replacement accessories, telephone 1-800-522-7746 in the United States. Outside the United States, contact the local representative, distributor or agent for Thermo Fisher Scientific products. Be sure to provide the catalog number and description of the part included in Table 1-1, plus the rotor model and serial number.

Table 1-2. Accessories Supplied

Quantity	Catalog Number	Description
8	03989*	ULTRACRIMP® tubes, Polyallomer, 35 ml (Pkg/25)**
8	03996*	Rotor Cap
1	03935*	Tube Racks, 4-place (1 pair)
1	12826*	ULTRACRIMP® Tube Removal Tool
1	51942	Rotor Stand
1	65937	Vacuum Grease
1	61556	Lubricant
1	51345	Overspeed Decal, 65 000 rpm, (extra)
2	64666	Rotor Cover O-Ring, Viton® (extra)
2	64667	Locking Nut O-Ring, Viton® (extra)
1	52392	Rotor Cover Tool
1	52384	Centrifuge/Rotor Log Book
1	52266	Instruction Manual

* Not supplied with Catalog No. 51411 (basic accessories only).

** Each package of tubes is supplied with an equal number of tube caps and tube plugs.

b. Optional Multipiece Sealing Assembly

If you prefer, you can use the T-865 Rotor with thinwall polyallomer tubes and aluminum sealing cap assemblies. These sealing assemblies consist of a tube plug, tube plug cover, sealing nut, and postfill screw. When the assembly is tightened, the cover crimps the top of the tube to form the seal. To use these assemblies, you must purchase all items separately: the T-865 Rotor with basic accessories only, Catalog No. 51411; a Tool Kit, Catalog No. 52610; the tubes; and the sealing assembly components. Table 1-2 lists the catalog number and description of the tubes and sealing assembly components required, and Table 1-3 lists the parts supplied in the Tool Kit. If you have the tools listed, you need not purchase the kit; or, if necessary, any of the tools listed can be ordered separately by the catalog number given in the table.

Table 1-3. Optional Multipiece Sealing Assembly Components

Catalog Number	Description
03141	Tubes, 36.0 ml, Polyallomer (Pkg/25)
52572	Sealing Cap Assembly (each); 8 required

Table 1-4. Tool Kit (Catalog No. 52610) for use with Multipiece Sealing Assembly

Catalog Number	Description
51834	Tube Cap Vise
52013	Tube Removal Tool
66298	Tube Cap Wrench, 3/4 inch

Note A Delrin® adapter (Catalog No. 00399) is available that fits the tube compartments of the T-865 Rotor. With this adapter, the rotor can also be used with 11.5 ml tubes and 10 ml tubes or bottles to a maximum speed of 30 000 rpm. For ordering information, please see Thermo Fisher Scientific Rotor and Tube Guide on our internet web site at http:// www.thermo.com

c. Rotor Cover Removal Tool

The rotor cover of the T-865 Rotor is designed to fit the rotor body tightly to ensure a positive seal; however, because of this tight fit, it is sometimes difficult to remove. If you have difficulty removing the rotor cover, a removal tool is available (Catalog No. 52652; complete instructions for use of the tool are supplied with it).

OPERATION

Contents

Prerun Safety Checks

To ensure safe performance of the rotor, before every run you should:

a. read the Safety Information Page in the front of this manual.

b. make sure each tube compartment is clean and that there is no sign of corrosion.

c. be sure the rotor itself is clean and shows no sign of corrosion or cracking. Also, make sure there are no scratches or burrs around the rim of the rotor.

d. check the centrifuge chamber and drive spindle to be sure that they are clean and free of scratches and burrs.

e. verify that the proper overspeed decal is firmly attached to the bottom of the rotor; the decal should have 14 black segments (see page 3-4 for Overspeed Decal Replacement procedure).

f. check the chemical compatibility of all materials used (see Appendix A).

g. inspect the rotor cover O-rings for cracks, tears, or abrasions; replace if necessary. Be sure the O-rings are properly lubricated.

h. make sure the rotor cover is on and properly tightened.

i. be sure that the proper environment has been selected for operation; for example, controlled ventilation or isolation, if required.

j. check the top speed capability of the tube (or bottle) being used.

CAUTION When using a tube or bottle assembly other than those supplied by Thermo Fisher Scientific, be sure to check the top speed capability; when in doubt, do a test run for the desired application. If using a Thermo Fisher Scientific tube (or bottle) assembly other than those supplied with the rotor, refer to the Product Guide for the maximum speed. Exceeding the top speed capability of the tube (or bottle) can result in its breakage.

Compartment Loads in Excess of Design Mass

The maximum operating speed (65 000 rpm) is based on the recommended design mass that has been established for this rotor, representing the maximum mass that each tube compartment can contain at top speed. The total contents of each compartment (including specimen, tube, rotor cap, tube cap, and tube plug) should not exceed the recommended figure unless the rotor speed is reduced proportionately. (If using optional multipiece sealing assembly, include the weight of the complete assembly.)

Strict adherence to the maximum allowable compartment mass or reduced speed is required to prevent rotor failure. Observe the WARNING on the Safety Information Page in the front of this manual.

The design mass for each compartment of the T-865 Rotor is 66 grams at 65 000 rpm. This figure is based on the use of a thinwall polyallomer tube filled with a liquid at 1.2 specific gravity, plus all sealing assembly components. If the total compartment mass is greater than 66 grams, use the following formula to determine the reduced speed:

$$\text{Reduced Speed} = 65000\sqrt{\frac{66\ \text{g}}{\text{Actual Weight}}}$$

Critical Speed

The critical speed is that speed at which any rotor imbalance will produce a driving frequency equal to the resonant frequency of the rotating system (that is, the rotor and the centrifuge drive). At this speed, the rotor may produce large amplitude vibrations which can be felt in the centrifuge frame. Mass imbalance will contribute to increased vibration intensity at the critical speed. Avoid operating the rotor at the critical speed, which is approximately 1200 rpm for the T-865 Rotor. Operation at the critical speed will have a detrimental effect on centrifuge component life. Observe the CAUTION on the Safety Information Page in the front of this manual.

Rotor Precool

If samples are routinely processed around 4°C or below, the rotor should be stored in a refrigerator or a cold room. If this is not possible, the rotor can be precooled in a Thermo Fisher Scientific Ultracentrifuge. Refer to the ultracentrifuge instruction manual for precooling directions. Be careful not to precool the rotor at its critical speed (read paragraph on page 2-2, Critical Speed).

Relative Centrifugal Force (RCF) Determination

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

$$\text{RCF} = 11.17(r)\left(\frac{\text{rpm}}{1000}\right)^2$$

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

and rpm = the rotor speed in revolutions per minute

Figure 2-1 shows the minimum, average, and maximum radii of the T-865. Table 2-1 gives the RCF value at each radius at speeds from 20 000 rpm to 65 000 rpm (in increments of 500 rpm). The RCF value at any other speed can be calculated by using the above formula.

Note The radii values given are the actual rotor specifications. These values do not take the thickness of the tube into consideration.

Table 2-5. T-865 Rotor: RCF Values and K Factors*

Speed (rpm)	RCF $r_{max.}$ 9.10 cm	$r_{avg.}$ 6.47cm	$r_{min.}$ 3.84 cm	**K Factors**
20 000	40 659	28 908	17 157	546
20 500	42 717	30 371	18 026	519
21 000	44 826	31 871	18 916	495
21 500	46 986	33 407	19 827	472
22 000	49 197	34 979	20 760	451
22 500	51 459	36 587	21 714	431
23 000	53 771	38 231	22 690	413
23 500	56 135	39 911	23 688	395
24 000	58 549	41 627	24 706	379
24 500	61 014	43 380	25 746	364
25 000	63 529	45 169	26 808	349
25 500	66 096	46 994	27 891	336
26 000	68 713	48 854	28 996	323
26 500	71 382	50 752	30 121	311
27 000	74 101	52 685	31 269	299
27 500	76 871	54 654	32 438	289
28 000	79 691	56 660	33 628	278
28 500	82 563	58 701	34 840	269
29 000	85 485	60 779	36 073	260
29 500	88 458	62 893	37 327	251
30 000	91 482	65 043	38 604	243
30 500	94 557	67 229	39 901	235
31 000	97 683	69 451	41 220	227
31 500	100 859	71 710	42 560	220
32 000	104 087	74 004	43 922	213
32 500	107 365	76 335	45 306	207
33 000	110 694	78 702	46 710	200
33 500	114 073	81 105	48 136	195
34 000	117 504	83 544	49 584	189
34 500	120 985	86 019	51 053	183
35 000	124 518	88 531	52 544	178
35 500	128 101	91 078	54 056	173
36 000	131 735	93 662	55 589	168
36 500	135 419	96 282	57 144	164

Table 2-5. T-865 Rotor: RCF Values and K Factors*

Speed (rpm)	RCF $r_{max.}$ 9.10 cm	$r_{avg.}$ 6.47cm	$r_{min.}$ 3.84 cm	K Factors
37 000	139 155	98 937	58 720	159
37 500	142 941	101 630	60 318	155
38 000	146 778	104 358	61 937	151
38 500	150 666	107 122	63 578	147
39 000	154 605	109 923	65 240	144
39 500	158 595	112 759	66 923	140
40 000	162 635	115 632	68 628	136
40 500	166 726	118 541	70 355	133
41 000	170 869	121 486	72 103	130
41 500	175 062	124 467	73 872	127
42 000	179 305	127 484	75 663	124
42 500	183 600	130 538	77 475	121
43 000	187 945	133 627	79 309	118
43 500	192 342	136 753	81 164	115
44 000	196 788	139 914	83 040	113
44 500	201 286	143 112	84 938	110
45 000	205 835	146 347	86 858	108
45 500	210 435	149 617	88 799	105
46 000	215 085	152 923	90 761	103
46 500	219 786	156 266	92 745	101
47 000	224 538	159 644	94 750	98.8
47 500	229 341	163 059	96 777	96.7
48 000	234 195	166 510	98 825	94.7
48 500	239 099	169 997	100 895	92.8
49 000	244 054	173 520	102 986	90.9
49 500	249 061	177 079	105 098	89.1
50 000	254 118	180 675	107 232	87.3
50 500	259 225	184 306	109 387	85.6
51 000	264 384	187 974	111 564	83.9
51 500	269 593	191 678	113 762	82.3
52 000	274 853	195 418	115 982	80.7
52 500	280 165	199 194	118 223	79.2
53 000	285 526	203 006	120 486	77.7
53 500	290 939	206 855	122 770	76.3
54 000	296 403	210 739	125 075	74.9

Table 2-5. T-865 Rotor: RCF Values and K Factors*

Speed (rpm)	RCF $r_{max.}$ 9.10 cm	$r_{avg.}$ 6.47cm	$r_{min.}$ 3.84 cm	K Factors
54 500	301 917	214 660	127 402	73.5
55 000	307 482	218 616	129 751	72.2
55 500	313 098	222 609	132 121	70.9
56 000	318 765	226 638	134 512	69.6
56 500	324 483	230 704	136 925	68.4
57 000	330 251	234 805	139 359	67.2
57 500	336 070	238 942	141 814	66.0
58 000	341 941	243 116	144 291	64.9
58 500	347 861	247 326	146 790	63.8
59 000	353 833	251 572	149 310	62.7
59 500	359 856	255 854	151 851	61.7
60 000	365 929	260 172	154 414	60.6
60 500	372 053	264 526	156 998	59.6
61 000	378 228	268 916	159 604	58.7
61 500	384 454	273 343	162 231	57.7
62 000	390 731	277 805	164 880	56.8
62 500	397 059	282 304	167 550	55.9
63 000	403 437	286 839	170 242	55.0
63 500	409 866	291 410	172 954	54.1
64 000	416 346	296 018	175 689	53.3
64 500	422 877	300 661	178 445	52.5
65 000	429 459	305 340	181 222	51.7

*These values do not take the thickness of the tube into consideration.

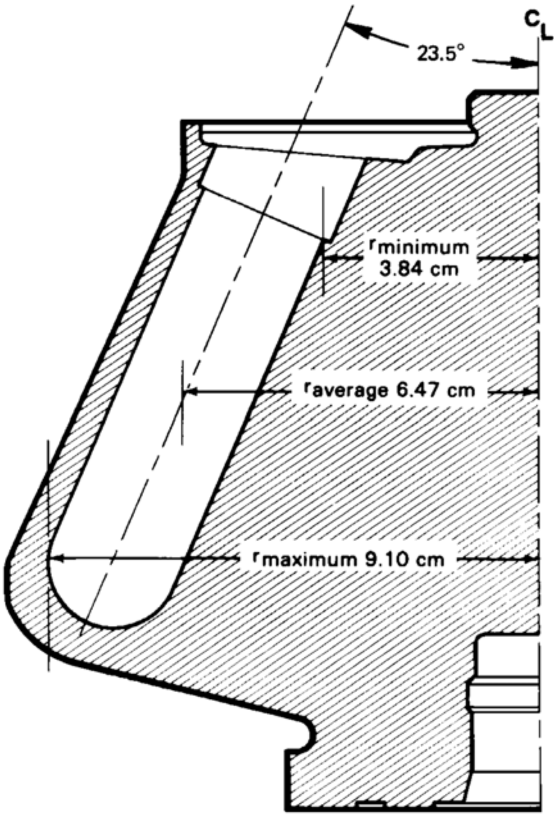

Figure 2-1. T-865 Rotor Radii

Calculation of Sedimentation Time in Aqueous (Non–gradient) Solutions

The time required to sediment a particle in water at 20°C through the maximum rotor path length (that is, the distance between rminimum and rmaximum) can be calculated using the equation:

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

where:

t = sedimentation time in hours
K = the clearing factor for the rotor (defined on the next page)
S_{20}, w = the sedimentation coefficient for the particle of interest in water at 20°C as expressed in Svedbergs[1]

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[1] The sedimentation coefficient (S) in seconds, for a particle in a centrifugal field is defined by the equation $S = (dx/dt)\,[1/(\omega^2 x)]$; where dx/dt = sedimentation velocity of the particle in cm/s; ω = rotor speed in rad/s; and x = the distance of the particle from the axis of rotation in centimeters. Conventionally, experimentally determined values of sedimentation coefficients are multiplied by 10^{13} to convert them to Svedberg units (S), so a particle with an experimentally determined sedimentation coefficient of 10^{-11} seconds is usually referred to in the literature as a "100 S particle." Since the value determined for the sedimentation coefficient is dependent on the density and viscosity of the solution in which centrifugation is performed, values are usually reported for the standard conditions of infinite dilution in water at 20°C, and designated S_{20}, w.

The clearing (or K) factor is defined by the equation:

$$K = (253000)\left[\ln\left(\frac{r_{maximum}}{r_{minimum}}\right)\right] \div \left(\frac{\text{rotor speed}}{1000}\right)^2$$

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

K factors for the T-865 Rotor, at speeds from 20 000 rpm to 65 000 rpm (in increments of 500 rpm), have been listed in Table 2-1.

Example: The T-865 Rotor has a K factor of 51.7 at the maximum permitted speed (65 000 rpm). If the particles to be sedimented have a sedimentation coefficient of 10S, the estimated run time required at maximum speed will be:

$$t = \frac{51.7}{10S} \; 5.17 \text{ hours} = 5 \text{ hours, } 10 \text{ minutes}$$

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

Chemical Compatibility

The critical components of the T-865 Rotor apt to come in contact with solution are: rotor body (titanium), rotor cover assembly (aluminum), rotor cap and tube cap (aluminum), tube plug (Buna N), O-rings (Viton®), plus the material of the tubes (or bottles) being used.

The chemical compatibility of rotor elements and accessory materials is given in the Appendix. Because no organized chemical resistance data exists for materials under the stress of centrifugation, this data is intended to be used only as a guide. When in doubt, we recommend pretesting of sample lots.

Rotor Balancing

Always balance the rotor according to the following criteria:

a. observe the CAUTION on the Safety Information Page in the front of this manual;

b. balance pairs of tubes containing fluid of identical specific gravity to within 0.5 gram and place them in opposite tube compartments;

c. when using less than a full complement of eight tubes, the rotor can be operated at its maximum allowable speed with two, four, or six samples, provided opposing pairs are positioned as shown in figure 2-2; and

d. if one, three, five, or seven samples are to be run, balance the load as above with a dummy tube that contains a solution of the same specific gravity as the sample in the opposing tube compartment.

Figure 2-2. Compartment Loading

Rotor Loading and Sealing

Prepare the ULTRACRIMP® tubes for use by following the tube filling and tube sealing procedures given in the ULTRACRIMP® Tube Sealing System Instruction Manual.

Note If using the optional tubes and multipiece sealing assemblies (Catalog No. 03141 and 52572 respectively), seal the tubes and load them in the rotor according to the instructions supplied with the sealing cap assemblies.

Load and seal the rotor as follows:

1. Gently place the filled and sealed ULTRACRIMP® tubes in the tube compartments, balancing the rotor as described in previous paragraph.
2. Place a rotor cap (Catalog No. 03996) in each tube compartment that contains a tube. Push the rotor cap into the tube compartment until it is properly seated; when properly seated, the edge of the cap will be approximately flush with the top of the outer edge of the tube compartment. See figure 2-3.

CAUTION Do not put a rotor cap in an empty tube compartment. Rotor caps should only be installed in compartments that contain a filled tube.

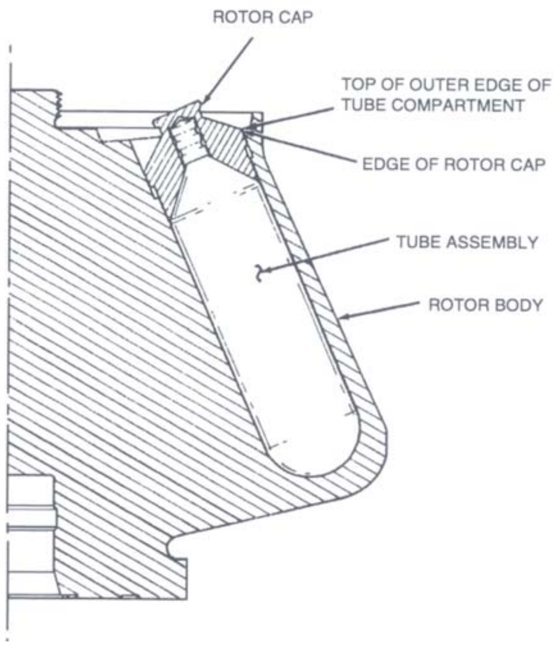

Figure 2-3. Properly Seated Rotor Cap

3. Check the locking nut O-ring and rotor cover O-ring for scuffs, cracks or breaks. Replace, if necessary (see Table 1-1 for replacement part catalog numbers).
4. Coat O-rings lightly with vacuum grease, Catalog No. 65937.
5. Check that the locking nut thread is lightly lubricated with grease, Catalog No. 61556.
6. Place the rotor cover (with O-ring) on the rotor body. Finger tighten the locking nut by turning it clockwise. Insert the rotor cover tool through locking nut and continue turning the locking nut clockwise until rotor cover is tightened securely. Remove the rotor cover tool from the locking nut.

CAUTION The rotor cover tool must be removed prior to centrifuge run.

7. Carry the rotor carefully, and lower it into the centrifuge chamber slowly and vertically. Be sure it snaps in place on the drive adapter. Check that the rotor is properly seated by pulling it gently in an upward direction and noting a small amount of resistance.

Perform the run as explained in the centrifuge instruction manual.

The rotor cover is designed to fit the rotor body tightly to ensure a positive seal; however, because of this tight fit, it is sometimes difficult to remove. If you have difficulty removing the cover, a tool is available that is used to easily remove the cover. The catalog number of the rotor cover removal tool is 52652; complete instructions for use of the tool are supplied with it.

Centrifuge/Rotor Log Book

An Ultracentrifuge/Rotor Log Book is supplied with the T-865 so that you can easily record all data necessary to meet the warranty stipulation that any defective ultracentrifuge rotor (or ultracentrifuge) returned to Thermo Fisher Scientific must be accompanied by an up-to-date history of the rotor.

Each time the T-865 Rotor is used, record the run in the log book. If desired, the information may be recorded elsewhere, however, it must include all data as shown in Figure 2-4, Sample Centrifuge/ Rotor Log Sheet.

Thermo Scientific Centrifuge and Rotor Log Book					RUN TIME (List by Rotor Used)								This log is for use with one centrifuge ONLY:
					Rotor S/N	*AH-629 8731384*	Rotor S/N	*TV-865 9130129*	Rotor S/N	*T-1270 8931255*	Rotor S/N	*T-880 9030040*	Model: *ULTRA 80* Ser. No.: *9102448*
Date	Operator	Rev. Count @ Run Start	TEMP	SPEED	HRS	MIN	HRS	MIN	HRS	MIN	HRS	MIN	Remarks*
09/04/91	J. JONES	00410290	4	57.0			05	30					*PLASMID PREP.*
09/05/91	B. SMITH	00429100	4	21.0	26	00							*SUCROSE GRADIENT*
09/07/91	J. JONES	00461860	21	70.0					18	00			*LIPOPROTEIN SEP.*

Figure 2-4. Sample Centrifuge/Rotor Log Sheet

CARE and MAINTENANCE

Contents

Corrosion

The T-865 titanium rotor body is more resistant to corrosion than an aluminum rotor body, but it should be maintained and kept clean in the same manner. With proper care, corrosion can be minimized to significantly prolong the useful life of the rotor and lessen the chances of rotor failure and potential damage to the centrifuge.

CAUTION Do not immerse, or in any other way allow liquid to enter and remain inside the bottom shield of a SUPER-LITE® rotor. Doing so can result in hidden contamination or corrosion, and make rotor failure possible.

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

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

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

Cleaning

These procedures are for general cleaning purposes only. If the rotor or any of its parts have been exposed to a contaminant, they must be decontaminated first, then washed.

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

a. Rotor Body

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

Do not use strong laboratory detergents to clean the rotor surface.

Use a bristle brush to loosen encrusted materials only if necessary; be careful not to scratch the rotor surface.

Ethylene oxide, a 2% glutaraldehyde solution, or ultraviolet radiation are the recommended methods of sterilization; however, the rotor body of the T-865 can be autoclaved at temperatures up to 121°C.

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

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

b. Rotor Cover Assembly (figure 3-1)

Wash the rotor cover assembly components with a mild detergent solution, rinse, then dry carefully before storing. DO NOT autoclave aluminum cover assembly. If required, use gas or chemical sterilization.

CAUTION Do not autoclave the rotor cover assembly. If any of its components are subjected to a temperature above 100°C, they should not be used.

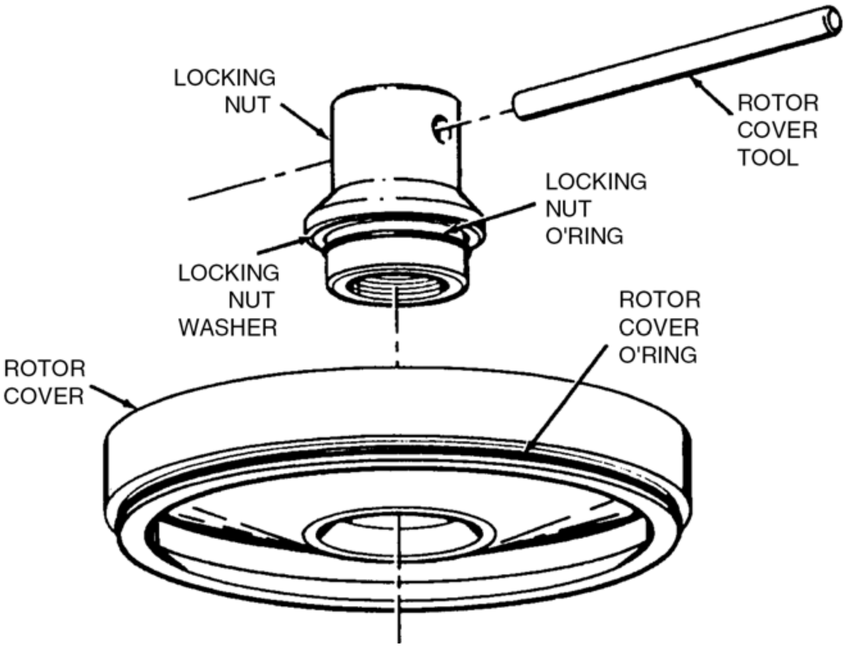

Figure 3-5. Rotor Cover Assembly

c. ULTRACRIMP® Sealing System Components

Autoclaving of the ULTRACRIMP® Sealing Tool and the aluminum rotor caps is not recommended. All parts may be cleaned with a lukewarm, 1% solution of a mild, non-alkaline detergent, such as a mild dishwashing liquid. The tube racks can be autoclaved.

d. Optional Multipiece Sealing Cap Assemblies (Catalog No. 52572)

1. Before each use:
   a. inspect tube plug covers as shown in figure 3-2;

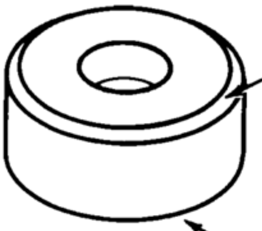

Figure 3-6. Tube Plug Cover Inspection

b. inspect the tube plugs as shown in figure 3-3;

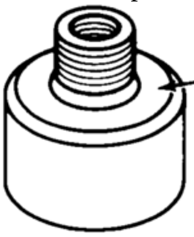

Figure 3-7. Tube Plug Inspection

c. replace tube plug covers and/or tube plugs, if necessary.

2. Wash the sealing cap assembly components regularly with a mild detergent solution, rinse and dry carefully before storing.

CAUTION Do not autoclave the tube plug covers or tube plugs. If these parts are subjected to a temperature above 100°C, do not use them.

Storage

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

Overspeed Decal Replacement

Before replacing the decal, be sure the rotor is dry and at room temperature; if it is not, the new decal will not adhere properly.

To replace the decal:

1. Remove the existing decal from the bottom of the rotor being careful not to scratch the rotor surface.
2. Clean the adhesive from the rotor surface using acetone or 3M General Adhesive Remover #8984.
3. Wipe the surface dry with a clean, soft cloth.

Note Check that the new decal has the correct number of black segments for the rotor being used. The decal for the T-865 Rotor should have 14 black segments.

4. Peel the paper backing off the new decal. Fit the decal into the recess in the bottom of the rotor. Be sure the decal is properly centered, then press the decal firmly in place.

Service Decontamination Policy

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

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

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

   Clean and decontaminate your centrifuge or rotor as follows:

   For ultracentrifuges:

   a. Remove rotor from the rotor chamber.

   b. Decontaminate door and rotor chamber using an appropriate method.

   For rotors:

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

2. Complete and attach DecontaminationInformation Certificate (in the back of your rotor or instrument manual) to the centrifuge or rotor before servicing or return to Thermo Fisher Scientific facility. If Certificate is not available, attach a written statement verifying decontamination (what was contaminant and what decontamination method was used).

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

1. Contact your Thermo Fisher Scientific representative to obtain a Return Service Order Number (RSO No.); be prepared with the name and serial number of the centrifuge or rotor and the repairs required.

2. Send item(s), with the RSO No. clearly marked on the outside packaging, to the address obtained from your Thermo Fisher Scientific representative.

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

If a centrifuge or rotor to be serviced does not have a Decontamination Information Certificate attached and, in Thermo Fisher Scientific's opinion, presents a potential radioactive or biological hazard, the Thermo Fisher Scientific representative will not service the equipment until proper decontamination and certification is complete. If Thermo Fisher Scientific receives a centrifuge or rotor at its Service facilities which, in its opinion, is a radioactive or biological hazard, the sender will be contacted for instructions as to disposition of the equipment. Disposition costs will be borne by the sender.

Decontamination Information Certificates are included with these instructions. Additional certificates are available from the local Account Representative or Field Service Engineer. In the event these certificates are not available, a written statement certifying that the unit has been properly decontaminated and outlining the procedures used will be acceptable.

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

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*, POLYCLEAR®, CLEARCRIMP®CCCLEARCRIMP®	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

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*, POLYCLEAR®, CLEARCRIMP®CCCLEARCRIMP®	POLYALLOMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYTHERMIDE	POLYRTHYLENE	POLYPROPYLENE	POLYSULFONE	POLYVINYL CHLORIDE	RULON A®, TEFLON®	SILICONE RUBBER	STAINLESS STEEL	TITANIUM	TYGON®	VITON®
Cesium Acetate	M	-	S	-	S	S	S	-	S	S	S	S	-	S	S	-	-	S	S	S	S	S	S	M	S	S	S
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

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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
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

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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
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

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*, POLYCLEAR®, CLEARCRIMP®CCCLEARCRIMP®	POLYALLOMER	POLYCARBONATE	POLYESTER, GLASS THERMOSET	POLYTHERMIDE	POLYRTHYLENE	POLYPROPYLENE	POLYSULFONE	POLYVINYL CHLORIDE	RULON A®, TEFLON®	SILICONE RUBBER	STAINLESS STEEL	TITANIUM	TYGON®	VITON®
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
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

*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. Because 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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