Thermo Scientific

H-12000 BioProcessing

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 H-12000 Lowspeed Swinging Bucket Rotor for 2-Liter Bottles

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 Fisher Scientific 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.

WARNING, CAUTION, and NOTE within the text of this manual are used to emphasize important and critical instructions.

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

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

NOTE highlights essential information.

CAUTION and WARNING are accompanied by a hazard symbol and appear 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. In the event of a rotor failure, 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 compartment load exceeds the maximum allowable compartment load specified. See “Compartment Loads in Excess of Design Mass” on 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 or salts (chlorides) of heavy metals such as cesium, lead, silver, or mercury. Use of these materials with aluminum can cause a chemical reaction that initiates corrosion.

Do not operate or precool a rotor at the critical speed, as this will have a detrimental effect on centrifuge component life. See “Critical Speed” on page 2-2.

Do not operate the rotor unless it is symmetrically balanced as described in this manual. Operating the centrifuge with the rotor out of balance can cause damage to the centrifuge drive assembly.

Do not operate the rotor without the windshield and fully-seated rotor body securely locked to the drive spindle, and the rotor cover in position. See “Prerun Safety Checks” on page 3-2.

Always maintain the rotor in the recommended manner. The rotor and accessories must be clean and inspected regularly. Do not use rotors showing signs of corrosion or cracking. See “Corrosion” on page 5-2.

DESCRIPTION

This manual contains information required to operate and maintain the Thermo Scientific H-12000 Swinging Bucket Rotor for 2-Liter Bottles. If you require additional information regarding operation or maintenance, please contact Thermo Fisher Scientific for assistance. Contact the nearest Thermo Fisher Scientific office (see Appendix C: “Contact Information”) 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 Thermo Scientific H-12000 Rotor (catalog number 77080) for 2-Liter Bottles is a six-bucket, high-capacity, lowspeed swinging bucket rotor that has been designed to address industrial bioprocessing user needs in a Thermo Scientific RC12BP and RC12BP+ Centrifuges. The rotor has a maximum rated speed[1] of 4,700 rpm and creates RCF (relative centrifugal force, or g-force) of 7,333 g at that speed.

The H-12000 Rotor for 2-Liter Bottles consists of a windshield and cover made of anodized aluminum alloy, an epoxy-paint covered stainless steel rotor body, and six anodized aluminum alloy buckets that can hold one 2-liter bottle each. Polypropylene 2-liter bottles (catalog number 3120-2002) must be run sealed, and require the use of a polypropylene support bridge (six supplied).

The size and weight of such a large rotor assembly are significant, so the H-12000 has been designed to separate for ease of handling and cleaning associated with normal use. The large rotor cover simply lifts off of the windshield and can be conveniently stowed on the inside of the open chamber door. Bottle stands and racks are available for worktop stability and ease of handling. The buckets can easily be lifted off of the rotor body's bolts, and the substantial rotor body separates from the large windshield so that it can be lifted all by itself to minimize the load.

In addition to this H-12000 for 2-Liter Bottles, an alternative version of the H-12000 Rotor is available for spinning blood bags. In that blood-processing version, the windshield assembly includes a molded polypropylene center hub apron designed to keep blood bag tabs/tubing from getting caught under the rotor body as the buckets swing. The other differences are that the 2-liter bottle support bridges are not included with the blood bag version, and different adapters and loading procedures are referenced in the manual.

Rotor Specifications

Table 1-1. Rotor Specifications

Rotor Type	Lowspeed Swinging Bucket	
	RC 12BP	RC 12BP+
Maximum Speed	4,700 rpm	4,700 rpm
Relative Centrifugal Force (RCF) at maximum speed:		
at $r_{minimum}$ (14.63 cm)	3,610 g	3,610 g
at $r_{average}$ (22.175 cm)	5,472 g	5,472 g
at $r_{maximum}$ (29.72 cm)	7,333 g	7,333 g
K Factor at maximum speed	8,117	8,117
Number of Buckets	6	6
Maximum Compartment (Design) Mass*	4,726 grams	4,726 grams
Contents Only (without Bucket)	2,160 grams	2,160 grams

[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 in this manual to speed will be designated as rpm.

Table 1-1. Rotor Specifications

Rotor Type	Lowspeed Swinging Bucket	
	RC 12BP	RC 12BP+
Rotor Total Capacity**	6, 2-litre bottles (approx. fill volume 2380 ml each)	6, 2-litre bottles (approx. fill volume 2380 ml each)
Critical Speed	400 rpm and 950 rpm	720 rpm and 1100 rpm
Balancing Margin, Opposing Loads	50 grams	50 grams
Rotor Diameter	64.1 cm (25.2 inch)	64.1 cm (25.2 inch)
Rotor Weight (empty)	47.8 kg (105.5 lb)	47.8 kg (105.5 lb)
Windshield	4.5 kg (10.0 lb)	4.5 kg (10.0 lb)
Rotor Body	25.7 kg (56.7 lb)	25.7 kg (56.7 lb)
Bucket (each)	2.6 kg (5.7 lb)	2.6 kg (5.7 lb)
Rotor Cover	2.2 kg (4.9 lb)	2.2 kg (4.9 lb)

*Maximum Compartment Mass includes mass of one bucket plus its contents (including any adapter, sample, container, or cover used).

**Dependent on blood bag/adapter/bottle used. Refer to the Thermo Fisher Scientific Product Guide for a complete listing of products/configurations available.

CAUTION The bucket has to be retired upon reaching the end of its life, which depends on the number of runs that may be performed, and varies depending on run speed. Exceeding the maximum number of cycles can result in rotor failure with subsequent damage to the centrifuge.

Table 1-2. Maximum Number of Cycles

max. speed	max. cycles
4,700 rpm	5,000
4,000 rpm	10,000
3,500 rpm	17,000

Parts and Accessories

Replaceable parts are listed in Table 1-3 and identified in Figure 1-1.

Table 1-3. Replaceable Parts (Item Numbers keyed to Figure 1-1

Item Number	Catalog Number	Quantity	Description
1	77038	1	Cover Assembly (includes 4,5,7 & 8)
2	77021	3	Rotor Buckets (pair)
3	11235	1	Drive Adapter
4	67483	1	Retaining Ring
5	11009	1	Speed Decal
6	11238	1	Locking Stud
7	11070	1	Cover Knob
8	11227	2	Nylon Washer

Table 1-3. Replaceable Parts (Item Numbers keyed to Figure 1-1

Item Number	Catalog Number	Quantity	Description
9	61835	3	Cap Screw, SST, #10-32 x 5/8 lg
10	77082	1	(balanced assy. Without molded apron)
11	75007686	2	Support Bridges (pair)

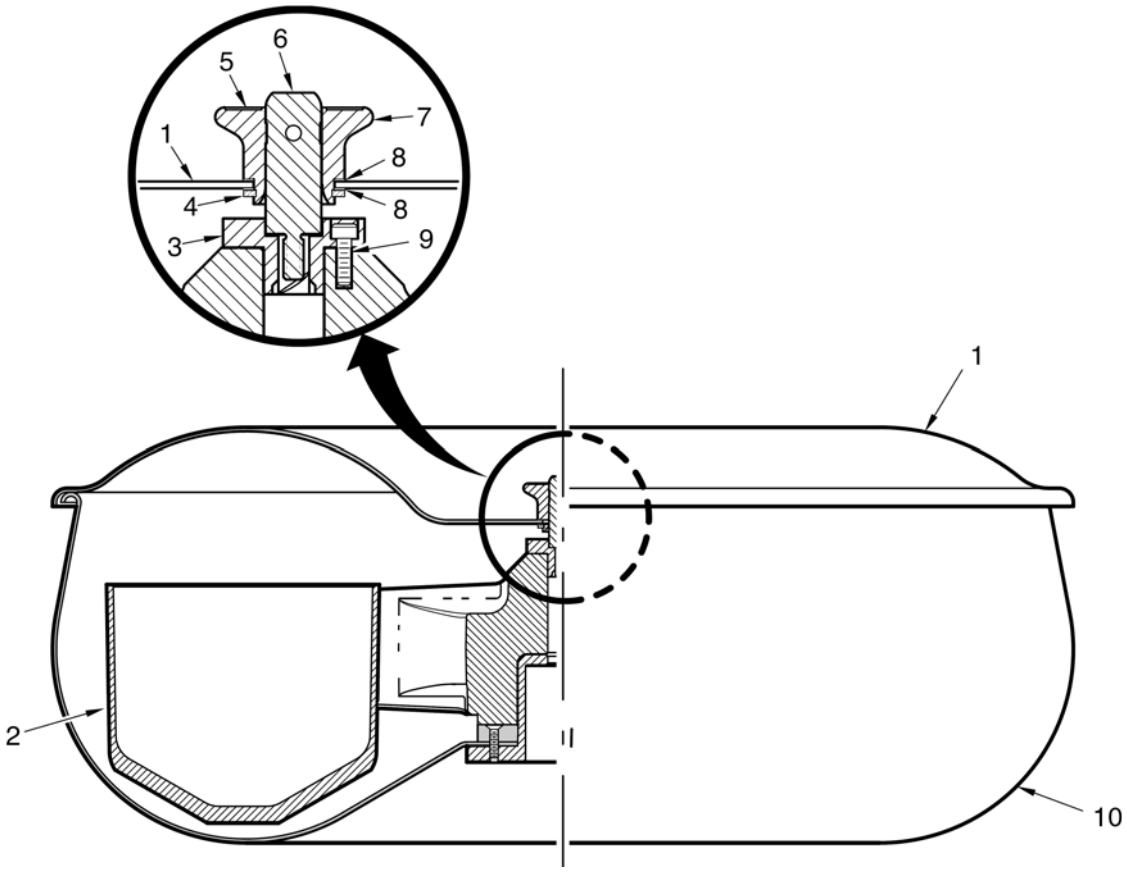


Figure 1-1. Parts of the H-12000 Rotor

Table 1-4 lists accessories for the H-12000 Rotor for 2-Liter Bottles.

Table 1-4. Rotor Accessories

Catalog Number	Quantity Supplied	Description
75007686	3 pkg	Support Bridge, 2-Liter Bottle (2/pkg)
12259	1	Rotor Cleaning Kit
11246	1	Rotor Locking Tool
65811	1	Loctite® #222 (for locking stud)
77083	1	Instruction Manual, H-12000 for 2-Liter Bottles
11445	-	Rotor Extractor Tool

To order replacement parts or accessories, please contact Thermo Fisher Scientific for assistance. Contact the nearest Thermo Fisher Scientific office (see Appendix C: "Contact Information") or your local representative for Thermo Fisher Scientific products. To ensure that you receive the correct part, be sure to provide a description of the item required, catalog number, rotor type, and serial number.

Adapters, Bottles and Related Items

Table 1-5 lists some of the adapters, bottles, and related items for the H-12000 Rotor.

Table 1-5. Adapters, Bottles und Related Items

Catalog Number	Description
77064	Adapter Rack (Qty. 1)
77065	Adapter Rack (Qty. 2)
77074	Adapter for 1L Bottle (Qty. 1)
75007065	Bioliner to H-12000 Adapter (Qty.1)
75007055	10 place adapter for 50ml conical (Qty. 1)
75007056	22 place adapter for 15ml conical (Qty. 1)
75007057	37 place adapter for 10ml blood collection tube (Qty. 1)
ME080001	54 place adapter for 13mm BD Vacutainer tube
ME060001	54 place adapter for 13mm Greiner tube
75007058	49 place adapter for 13mm Blood Collection tube
3120-2002	2L Nalgene PP Bio-Bottle (Qty. 2)
3120-1000	1L Nalgene PP Bottle (Qty. 4)
3122-1000	1L Nalgene PC Bottle (Qty. 4)

Other than running 2-liter bottles, the H-12000 Rotor can be teamed with a 1-liter adapter (catalog number 77074) so that the rotor can accept all tube/bottle configurations available for the Thermo Scientific H-6000A Rotor. For a complete list and description of available Thermo Scientific products, please refer to the most current Thermo Fisher Scientific Product Guide. To order or for more information contact the nearest Thermo Fisher Scientific office (see "Contact Information" on page D-1) or your local representative for Thermo Fisher Scientific Product information is available on our internet web site at http://www.Thermo.com .

SPECIAL CONSIDERATIONS

This chapter contains the information necessary to prepare the H-12000 Rotor for 2-Liter Bottles for operation and includes important safety information.

Contents

Critical Speed

CAUTION Do not operate or precool the rotor at the critical speed, as this will have a detrimental effect on centrifuge component life.

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 instrument frame. Mass imbalance will contribute to increased vibration intensity at the critical speed. Avoid operating the H-12000 Rotor at or near its critical speed. Operation within 100 rpm of critical speed will have a detrimental effect on centrifuge component life and should be avoided.

Chemical Compatibility

The critical components of the H-12000 Rotor that are apt to come in contact with solution are: rotor body (epoxy painted stainless steel), rotor buckets, windshield, and rotor cover (anodized aluminum), windshield molded hub, bucket liners and liner covers (polypropylene), other hub components (stainless steel), plus the material of the bottles or blood bag assemblies being used. As reference, Chemical Compatibility Charts can be found in "Chemical Compatibility Chart" on page B-1 of this manual. 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 the effect of a specific chemical on sample adapters and tubes or bottles to be used with this rotor.

Compartment Loads in Excess of Design Mass

WARNING Always reduce (derate) rotor speed of the installed rotor as instructed in this manual whenever the compartment load exceeds the maximum allowable compartment load specified. Failure to reduce rotor speed under these conditions can cause rotor failure.

A design mass has been established for the rotor representing the maximum mass that each rotor compartment can contain at topspeed operation (4,700 rpm). To prevent rotor failure, the total contents for each rotor compartment, including bucket, adapter (if used), blood bags or bottle, and sample should not exceed the design mass unless the rotor speed is reduced proportionately. Strict adherence to this maximum speed limitation based on actual compartment mass is required to prevent rotor failure.

The design mass for each rotor compartment (bucket and contents) of the H-12000 is 4,726 grams at 4,700 rpm. If the compartment mass is greater than that figure, the maximum allowable speed can be determined by using the following formula or the reducing curve shown in figure 2-1:

$$\text{Reduced Speed} = \text{maximum Speed} \sqrt{\frac{\text{maximum load}}{\text{actual load}}}$$

Because the rotor buckets may not normally be removed from the rotor between each run, it might be more convenient to think in terms of the bucket contents only (loaded bottle assembly/support bridge/adapter, without the bucket). At maximum speed, the maximum mass of the bucket contents alone is 2,160 grams which, if added to the mass of an empty bucket (2,566 grams), equates to the 4,726 gram design mass figure.

For ease of reference, the speed reducing curves show both a bucket plus contents scale as well as a contents only scale.

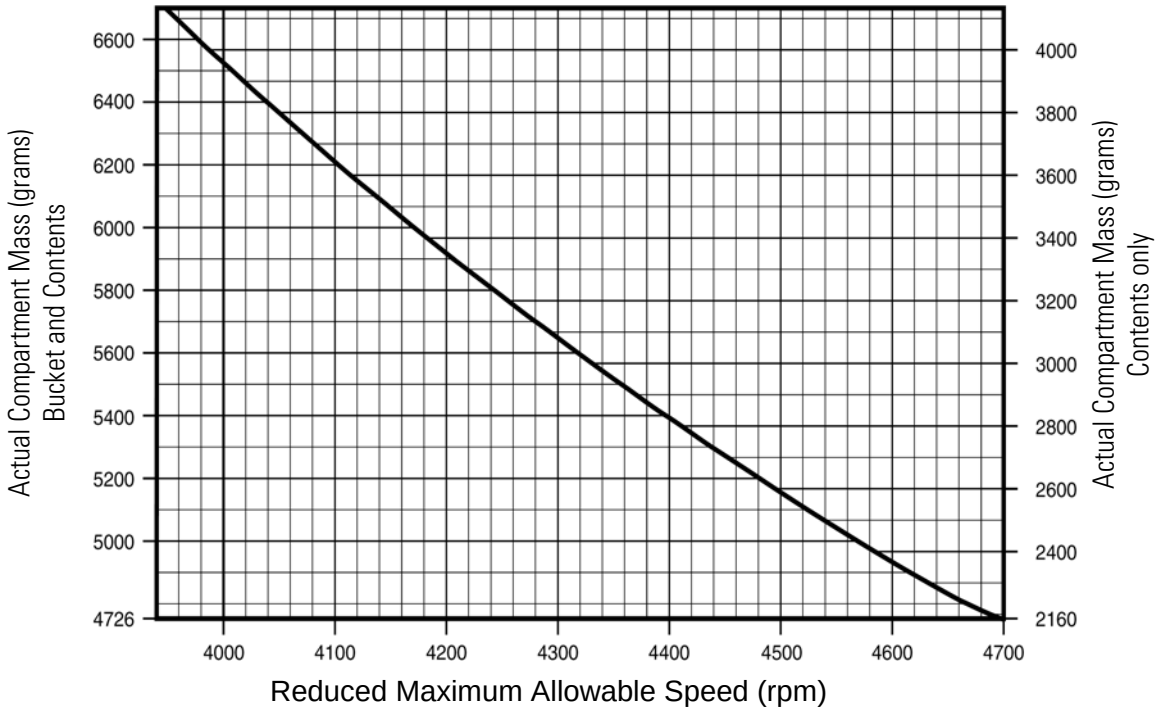


Figure 2-2. Reducing Speed for Excess Mass

Note To accurately calculate using the formula supplied above, reduced speed should always be calculated based on the larger, bucket plus contents mass of 4,726 grams. This means that if you weigh your loaded adapter und bottle and the mass exceeds 2,160 grams, you would then have to add 2,566 to that number to determine an Actual Compartment Mass number to use in the formula.

EXAMPLE OF SPEED REDUCTION FOR 2-LITER BOTTLE

For example, the 2-Liter Bottle's fill volume is approximately 2,380ml. If filled with a 1.0g/ml sample, the bottle (with support bridge and sealing assembly) could easily weigh 2,710g (5,276g including bucket), exceeding the rotor design mass of 2,160g (4,726g including bucket). In this example, referring to the speed reduction curve above, maximum rotor speed must be reduced to 4,450rpm.

Most applications for the 2-Liter Bottle require forces significantly less than those produced at reduced speeds. If higher speed is required, reduce mass by reducing sample volume.

Relative Centrifugal Force (RCF) Determination

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

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

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 2-2 shows the minimum, average, and maximum radii of the rotor. The RCF value for each radius at speeds from 500 rpm to 4,700 rpm (in increments of 500 rpm) can be found in "RCF-Values" on page A-1. The RCF value at any other speed can be calculated by using the formula given above.

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

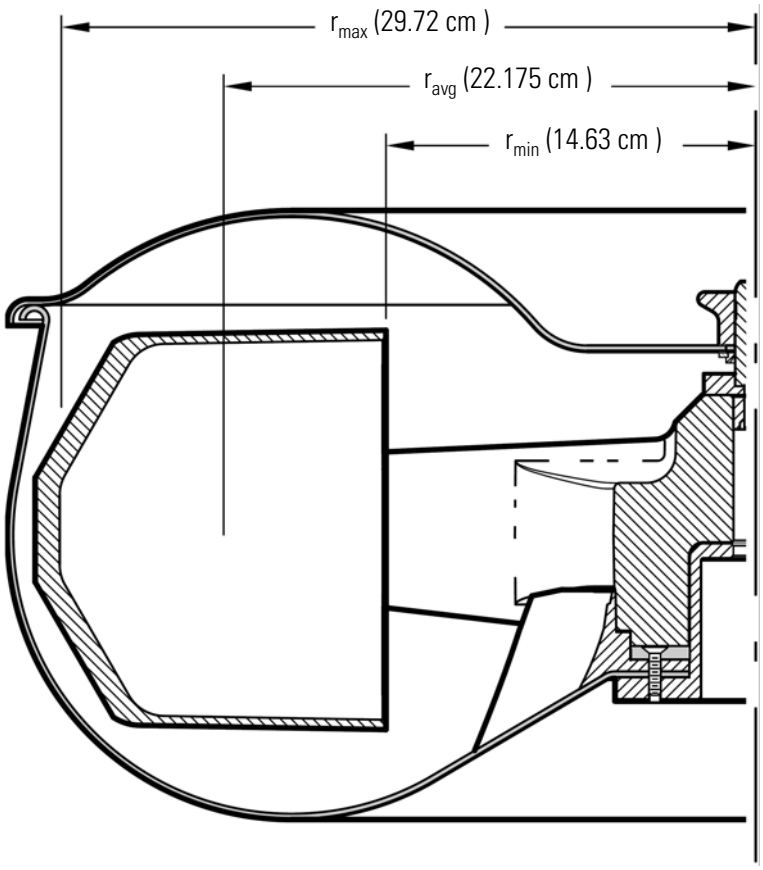


Figure 2-3. Cross Section Showing Radial Distances

RUN PREPARATION

This chapter contains the information necessary to prepare the H-12000 Rotor for 2-Liter Bottles for operation and includes important safety information.

Contents

Prerun Safety Checks

To ensure safe performance of the rotor, check the following items before every run:

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

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

c. make sure that the rotor body (particularly the bolt area) and the buckets (particularly the bolt mating surfaces) have no burrs, scratches, cracks or signs of corrosion.

d. check the centrifuge chamber, drive spindle, and mounting surface of the rotor to be sure they are clean and free of scratches and burrs.

e. check chemical compatibility of all materials used (refer to the "Chemical Compatibility Chart" on page B-1).

f. wipe the inside of the rotor shell to remove any liquid (that is, water, blood, or any other fluid) and any loose particles or objects.

g. gently move each bucket to ensure that they swing freely and are properly seated, and also make sure that bucket contents are within the Rotor Compartment Envelope ("Rotor Compartment Envelope" on page 3-4).

h. make sure that the bucket loads are symmetrically balanced. Equalizing sample loads within bottles.

Rotor Installation

Note Two people are required for this procedure.

Before installing the rotor, make sure that the rotor's center hole and drive spindle are clean and dry, and free of nicks and scratches. Also, make sure that all rotor parts, the centrifuge chamber surfaces, and the drive spindle are clean and dry.

1. Grasping the rotor windshield assembly's metal center hub with one hand, lift the windshield assembly and gently lower it onto the centrifuge drive spindle. Then, rotate the windshield until the locating pin (extending vertically from the center hub plate) is centered on one of the four sides of the square drive spindle.

2. Identify arm 1 on the rotor body (the hole for the center hub's locating pin is under arm 1). Orient the rotor body so that arm 1 will engage the pin when the body is lowered into position.

3. Using two people grasping the ends of its arms only (read the WARNING). Lift the rotor body and carefully position it on the drive spindle. Gently lowering it into the windshield so that it fully engages the square spindle, the locating pin at arm 1, and the molded center hub.

WARNING The rotor body weighs 25.7 kg (56.7 lbs) and should be lifted by two people whenever it is installed or removed.

4. Apply two to three drops of Loctite® #222 (Catalog No. 65811, supplied) to the threads of the rotor locking stud (Catalog No. 11238). Then, insert the rotor locking stud into the rotor's square

center hole and thread it counterclockwise into the drive spindle. Use the rotor locking tool to tighten the locking stud and secure the rotor to the drive spindle.

CAUTION
(1) The centrifuge spindle bearings can be damaged if the rotor body is dropped on the drive spindle.
(2) To prevent possible damage to the rotor or centrifuge, apply two or three drops of Loctite® #222 to the threads of the rotor locking stud. Tighten the locking stud securely. This should be done each time that the rotor is removed and reinstalled.

5. Clean and lubricate the rotor trunnion bolts and both bolt seats on the sides of each bucket (use the Rotor Cleaning Kit, Catalog No. 12259, supplied).
6. Install an empty bucket in each position, making sure that each bucket is fully seated and pivots freely on its trunnion bolts.

Note Always use a full complement of six buckets, even if some are to remain empty.

Removal is the reverse of installation. If the rotor body sticks so that it cannot be lifted from the drive spindle, we recommend the use of a rotor extractor tool, Catalog No. 11445.

2-Liter Bottle Loading/Assembly

Note H-12000 rotor buckets, designed for maximum volume, have significant bottom portions that are angled upward, not flat. Because of this, during loading, 2-Liter Bottles may tend to tip over if they are not properly supported. We recommend using either Single Adapter/Bottle Stands (Catalog No. 77064), or a six-place Adapter/Bottle Rack System (Catalog No. 77065) to properly support bottles during loading and transporting.

Fill each bottle with the desired amount of sample, being sure to balance opposing loads (see "Rotor Loading and Balancing" on page 3-5). NALGENE 2-Liter Bottles may be run either partially-filled or filled up to the bottom thread in the bottle neck. Although full loading may necessitate reducing rotor speed (see "Compartment Loads in Excess of Design Mass" on page 2-2).

Each NALGENE 2-Liter Bottle (catalog number 3120-2002, 2/pkg) requires using a sealing assembly (cap and o-ring, supplied), but also requires the use of a support bridge (supplied) assembled as shown in Figure 3-4 on page 3-4, then placed in a rotor bucket so that the bridge engages the top edge of the bucket. Observe the CAUTION.

CAUTION Always use a support bridge and a securely tightened sealing assembly. Failure to do so can cause the deformation or collapse of the bottle during centrifugation, possibly resulting in loss of sample with damage to the rotor and centrifuge.
Bottles showing damage (creases, cracks or crazing) should not be used.

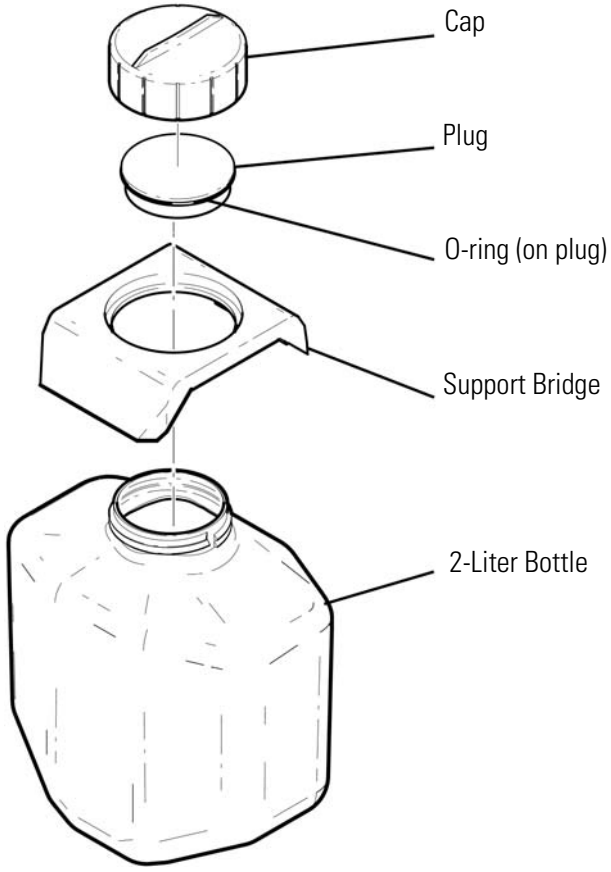


Figure 3-1. Assembling the 2-Liter Bottle

Rotor Compartment Envelope

Note This paragraph applies when using 1-liter adapters with lesser volume tubes, bottles or adapters that are not fully contained within the rotor bucket. Safe clearance is ensured when NALGENE 1 or 2-liter bottles are used.

The rotor compartment envelope is that area within which the rotor bucket contents (including any adapters, tubes, bottles, covers or sealing assemblies) must remain to ensure proper clearance and safe operation. In swinging bucket rotors, the clearance of the bucket and its contents as they swing from the vertical to the horizontal position during centrifugation is very important. Proper clearance must be allowed to prevent bucket contents from hitting the rotor body or rotor cover and breaking, resulting in loss of sample and possible equipment damage, or otherwise interfering with normal bucket movement and rotor function.

Before actually loading sample or performing a run using a new tube/bottle/adapter configuration in the H-12000, prequalify bucket contents (including covers/sealing assemblies) by installing them in the rotor and checking both the swing clearance from the rotor body as well as the vertical (at rest) clearance against the inside of the rotor cover. After prequalifying, standardize on those tube/bottle/adapter configurations that are proven to be acceptable.

CAUTION Always ensure that bucket contents are fully contained within the rotor compartment envelope. Failure to do so can result in tube breakage, loss of sample, and possible damage to the rotor and centrifuge.

Rotor Loading and Balancing

Note We recommend a Six Adapter Rack (Catalog No. 77065) to transport loaded adapters/bottles to the centrifuge.

CAUTION Always run with a full complement of six buckets. If only two, three, or four buckets are to be used, place loaded adapters in opposing compartments for balance, and be sure to leave empty buckets in remaining positions.

1. Before loading the rotor, make sure all rotor bolts and bucket bolt seats are clean and lubricated (use Rotor Cleaning Kit, Catalog No. 12259, supplied). The buckets must be properly seated and pivot freely.

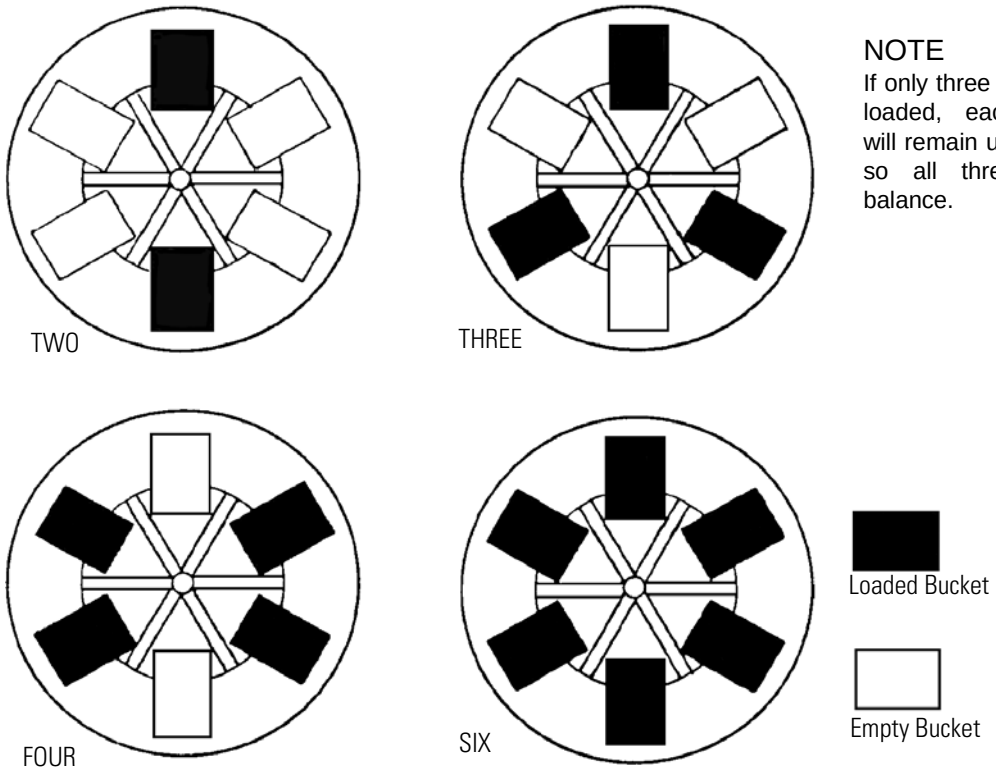


Figure 3-2. Rotor Balancing

Note The rotor can be used with loaded buckets in two (2), three (3), four (4), or six (6) positions. The loaded buckets must be symmetrically positioned on the rotor as shown in figure 3-5 and empty buckets must be placed in the remaining positions

2. Load and balance the rotor according to the following criteria:

   - if using 2-liter bottles, a support bridge must be installed on the bottle and the sealing assembly must be securely tightened (see 2-Liter Bottle Loading/Assembly).
   - the maximum compartment mass (2,160 grams for bucket contents only, 4,726 grams for bucket contents and bucket) must not be exceeded unless maximum rotor speed is reduced (see"Compartment Loads in Excess of Design Mass" on page 2-2).
   - the contents of each rotor bucket must allow for proper swing clearance (see "Rotor Compartment Envelope" on page 3-4).
   - the buckets must be symmetrically balanced as shown in Figure 2-4. The contents of opposing buckets should be balanced to within 50 grams of each other. To do so, equalize sample loading within opposing adapters or adjust fill volumes in large-capacity bottles.

Note Balancing opposing loads to within 50 grams is specified to protect against life-shortening wear or damage to the centrifuge. Focused blood bank study has shown that, when running blood bags, excess imbalance does not affect realized yield or product quality.

WARNING Operating the centrifuge without balancing opposing buckets to within 50 grams can cause undue wear on the motor and gyro assembly (wear potential increases proportionately with degree of imbalance).
Do not balance loads by adding liquid around the outside of blood bags or bottles, or by using rubber stoppers or similar objects. Liquid could exit the bucket during centrifugation and deform the rotor windshield due to hydrostatic pressure build-up. If an object were to exit the rotor bucket and get lodged between the rotor and rotor windshield, damage to the centrifuge could result.

OPERATION

Contents

Operation

CAUTION Before each run, wipe the inside of the rotor wind shield to remove any liquid (for example water or blood). Failure to remove liquids from the inside of the wind shield can cause it to become deformed because of the hydrostatic pressure built up during centrifugation.

Read and observe the "Prerun Safety Checks" on page 3-2.

1. Make sure that there are no loose objects inside the rotor chamber, for example, clips, tubing, tape, labels.
2. Wipe the inside of the rotor wind shield to remove any liquid (for example, water or other fluid).
3. Install the rotor cover: Position the cover knob over the rotor locking stud. (The cover rests on the windshield and does not lock in place. To remove it, simply lift the knob vertically.)
4. Perform the run as explained in the centrifuge instruction manual.

Note There will be a short period of vibration during acceleration as the rotor passes through the critical speed range. This is a natural reaction and should cause no concern unless the vibration becomes excessive. In that event, stop the centrifuge immediately and rebalance the bucket loads.

At the end of the run, remove the rotor cover and stow it on the underside of the centrifuge door. Holding the middle of a bucket to steady it, lift the adapter/bottle straight up and out of each bucket.

Note We recommend a Six Adapter Rack (Catalog No. 77065) to transport loaded adapters/bottles from the centrifuge.

If you need to remove the rotor, it is the reverse of installation. If, after removing the rotor locking stud, the rotor body will not separate from the drive spindle, we recommend the use of a rotor extractor tool, Catalog No. 11445.

Container Leakage/Breakage and Hazardous Materials

There are many factors which influence the maximum speed at which tubes or bottles can be run without leakage or breakage. These factors include the dimension, tolerance, and quality of the containers themselves, the chemical compatibility of the sample with the container material, container condition and previous run stresses, and the volume of fluid within the container. If leakage or breakage is experienced regularly, make sure you are using the correct adapter and are operating within the container speed limits (check manufacturer's recommendations).

Containers can be tested before use by loading them with water and running them to the required speed with the proper adapter. Even with pretesting, the potential for leakage or breakage still exists. With reusable containers, leakage or breakage also occurs as the unobservable effect of repeated stress comes into play when the containers are used again and again.

The rotor cannot prevent liquids from escaping in the event of container leakage. Do not rely on the rotor or centrifuge as a means of safeguarding yourself and the environment when handling pathogenic microorganisms. If tubes break that contain hazardous materials, the entire rotor load, centrifuge, and

area should be considered contaminated and treated as such. All affected items should be decontaminated using appropriate decontamination procedures (see "Cleaning and Decontamination" on page 5-2 regarding methods for this rotor).

If you are running radioactive, toxic, or pathogenic materials, we recommend additional precautions be taken to prevent exposure to these materials, for example, use of controlled ventilation or isolation areas. Observe the WARNING.

WARNING
When using radioactive, toxic, or pathogenic materials, be aware of all characteristics of the materials and the hazards associated with them. If leakage occurs during centrifugation, neither the rotor nor the centrifuge can protect you from particles dispersed into 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.
If containers break that contain hazardous materials, the entire rotor load and centrifuge should be considered contaminated and treated as such. The rotor, adapters, buckets, containers, wind shield, and centrifuge chamber should be decontaminated using appropriate decontamination procedure.

CARE and MAINTENANCE

This chapter provides instructions on how to clean, decontaminate, and maintain your rotor. Always maintain the rotor in the recommended manner. Do not use rotors or buckets that show signs of corrosion or cracking.

Contents

Corrosion

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

The rotor body is made of epoxy painted stainless steel, the windshield, cover, and buckets are made of anodized aluminum alloy, and other hub components are made of stainless steel. Although corrosion resistance is good, proper care will minimize the chance of corrosion, prolonging the useful life of the rotor and will lessen the chance of rotor failure. Refer to the Chemical Compatibility Charts (see "Chemical Compatibility Chart" on page B-1) for information regarding resistance to specific chemicals.

Corrosion commonly refers to chemical reactions at the surface (such as rusting and pitting) recognized the growing areas of visible deterioration. Stress corrosion attacks the inside of the metal. Barely detectable surface cracks grow inward, weakening the part without visible warning. Stress corrosion applies to most commonly used alloys. Even the corrosion resistant alloys have been found susceptible.

Stress corrosion is thought to be initiated by certain combinations of stress and chemical reactions. 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 or buckets are not kept clean and chemicals remain on them, corrosion will result. Also, any moisture left on the rotor or buckets for an extended period of time can initiate corrosion. Therefore, it is important that rotor and buckets are thoroughly dried after use.

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

Cleaning and Decontamination

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

WARNING 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.

Cleaning

The rotor body, windshield, and buckets should be cleaned with warm water and a mild soap or detergent as required. It is particularly important to wash all parts after any spills have occurred. Most laboratory chemicals can be removed with a lukewarm 1% solution of a mild, non-alkaline detergent such as dishwashing liquid. Rinse the rotor body and buckets well, inside and out. After rinsing, dry thoroughly with a soft absorbent cloth.

Clean, inspect, and relubricate the pins on the rotor body and the bucket surfaces that mate with the pins once a week.

Do not use strong laboratory detergents to clean the rotor surface. Use a soft bristle brush to loosen encrusted materials only if necessary. Be careful not to scratch the rotor surface.

CAUTION (1) Do not use alkaline laboratory detergents on aluminum rotor parts, or corrosion could result.
(2) The rotor windshield assembly is dynamically balanced by affixing precise amounts of a grey, putty-like balancing compound inside the windshield. During cleaning, be careful not to remove the compound, or increased imbalance will result.

Cleaning Swinging Bucket Rotors

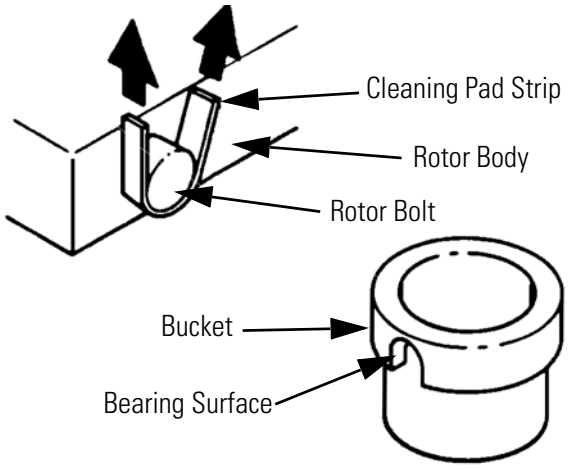
Listed below are the materials required to properly maintain your swinging bucket rotors.

- PN 66309, Scotchbrite® Brand Cleaning Pad
- PN 70006692, Lubricant

At least once a week, the rotor body and the individual buckets should be washed in a solution of warm water and a mild detergent. After drying, inspect the rotor and buckets making sure they are thoroughly clean. Pay particular attention to the rotor bolts and the mating bearing surfaces of the buckets.

Clean the bucket surfaces and rotor bolts as follows (refer to illustration):

1. Cut the cleaning pad (PN 66309) into 1/2 inch (12 mm) wide strips.
2. Saturate one of the pad strips with acetone or alcohol.
3. Wrap the pad strip around a rotor bolt and move it back and forth in an oscillating motion. Move the strip around to clean the pin completely. Repeat this process for each rotor pin.
4. Saturate another pad strip and thoroughly clean the mating bearing surfaces of each bucket.



5. Wipe the cleaned surfaces with a clean, dry cloth.
6. Lightly lubricate each bolt and bearing surface with the lubricant (PN 70006692) supplied.

After all cleaning is completed, place the buckets on the rotor bolts and check that all buckets swing freely. Worn or damaged bolts and/or buckets may cause binding. Careful examination will determine which part is defective and must be replaced.

WARNING The buckets must swing freely for proper operation. DO NOT operate the rotor if any bucket binds on the rotor bolts.

Decontamination

The rotor body, windshield, cover, and buckets can be autoclaved at temperatures up to 121°C (250°F) at 15 psi for 15 minutes. Ethylene oxide, a 2% glutaraldehyde solution, or ultraviolet radiation are the recommended methods of sterilization.

Note If you decontaminate the rotor by autoclaving, be sure to remove any condensation that has formed inside the windshield before using the rotor

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
(1) Do not decontaminate the rotor's aluminum cover, buckets, or windshield using sodium hypochlorite solutions since these solutions cause discoloration, attack the anodized finish, and initiate corrosion. Use of popular laboratory sanitizing wipes with very low concentrations of chlorine bleach (0.5%) followed by a thorough water rinse is believed to have minimal short-term adverse effect. Long-term effect is unknown.
(2) Most commercially available radioactivity decontaminants are not compatible with aluminum.

Service Decontamination Policy

WARNING Because of the characteristics of the samples likely to be processed in this centrifuge, biological or radioactive contamination may occur. Always be aware of this possibility, and take normal precautions. Use appropriate decontamination procedures should exposure occur.

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 or rotor to be serviced of all encrusted material and decontaminate it (see "Cleaning and Decontamination" on page 5-2 and Care and Maintenance section of centrifuge instruction manual) prior to servicing by the Thermo Fisher Scientific representative or returning it 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 Care and Maintenance Section of 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 lowspeed floor model centrifuges:

a. Remove rotor from the rotor chamber.

b. Remove, wash, and decontaminate motor sealing gasket and pad.

c. Decontaminate lid, rotor chamber, and drive using an appropriate method.

d. Remove all encrusted material from around the motor and drive assemblies.

For rotors:

Remove tubes, bottles, and adapters from the rotor and decontaminate rotor using an appropriate method. If tubes or rotor caps are stuck in the rotor, or the rotor lid is stuck, notify Thermo Fisher Scientific representative. Be prepared with the name and nature of the sample so 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 Decontamination Information 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 Scientific 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 of packaging to the address obtained from your Thermo representative.

Note United States federal regulations require 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. All disposition costs will be borne by the sender.

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

Note The Thermo Scientific Authorized Representative will note on the 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.

RCF-Values

RPM	RCF $r_{maximum}$ 29.72	RCF $r_{avgerage}$ 22.175	RCF $r_{minimum}$ 14.63	K FACTOR
400	53	40	26	1,120,705
500	83	62	41	717,251
600	120	89	59	498,091
700	163	121	80	365,944
800	212	159	105	280,176
900	269	201	132	221,374
1,000	332	248	163	179,313
1,100	402	300	198	148,192
1,200	478	357	235	124,523
1,300	561	419	276	106,102
1,400	651	485	320	91,486
1,500	747	557	368	79,695
1,600	850	634	418	70,044
1,700	959	716	472	62,046
1,800	1,076	803	529	55,343
1,900	1,198	894	590	49,671
2,000	1,328	991	654	44,828
2,100	1,464	1,092	721	40,660
2,200	1,607	1,199	791	37,048
2,300	1,756	1,310	864	33,897
2,400	1,912	1,427	941	31,131
2,500	2,075	1,548	1,021	28,690
2,600	2,244	1,674	1,105	26,526
2,700	2,420	1,806	1,191	24,597
2,800	2,603	1,942	1,281	22,872
2,900	2,792	2,083	1,374	21,321
3,000	2,988	2,229	1,471	19,924

RPM	RCF			K FACTOR
	$r_{maximum}$ 29.72	$r_{avgerage}$ 22.175	$r_{minimum}$ 14.63	
3,100	3,190	2,380	1,570	18,659
3,200	3,399	2,536	1,673	17,511
3,300	3,615	2,697	1,780	16,466
3,400	3,838	2,863	1,889	15,511
3,500	4,067	3,034	2,002	14,638
3,600	4,302	3,210	2,118	13,836
3,700	4,545	3,391	2,237	13,098
3,800	4,794	3,577	2,360	12,418
3,900	5,049	3,767	2,486	11,789
4,000	5,312	3,963	2,615	11,207
4,100	5,580	4,164	2,747	10,667
4,200	5,856	4,369	2,883	10,165
4,300	6,138	4,580	3,022	9,698
4,400	6,427	4,795	3,164	9,262
4,500	6,722	5,016	3,309	8,855
4,600	7,025	5,241	3,458	8,474
4,700	7,333	5,472	3,610	8,117

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
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*, 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 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
Hydrochloric Acid (conc.)		U	U	U	U	-	U	U	M	-	U	M	U	U	M	U	U	U	-	S	-	U	S	U	U	U	-	-

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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
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

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®
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
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

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®
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.

Warranty

Thermo Fisher Scientific makes no warranty of any kind, expressed or implied, except as stated in this warranty policy.

Each Thermo Scientific H-12000 Rotor is warranted against defects in material and workmanship, subject to the conditions stated below and in the Thermo Fisher Scientific terms and conditions of sale in effect at the time of sale, for seven (7) years at any speed up to 4,700 rpm (properly reduced for certain fluid densities, fluid gradients, tube assemblies, and adapters as described in these operating instructions).

Conditions

a. This warranty is valid for seven (7) years from the date of shipment to the original buyer by Thermo Fisher Scientific or an authorized Thermo Fisher Scientific Representative.

b. This warranty extends only to the original Buyer and may not be assigned or extended to a third person without the written consent of Thermo Fisher Scientific.

c. This warranty covers the rotor and its buckets only and Thermo Fisher Scientific shall not be liable for damage to accessories or ancillary supplies including but not limited to (i) blood bags, (ii) tubing/filters, (iii) bottles, (iv) caps/covers, (v) bucket liners/adapters, or (vi) blood bag/bottle contents.

d. This warranty is void if the rotor is (i) operated or maintained in a manner contrary to the instructions in the manual for the rotor or centrifuge in use, or (ii) used in a Thermo Scientific Centrifuge that has been modified without the written permission of Thermo Fisher Scientific.

e. Should a Thermo Scientific Centrifuge be damaged due to the failure of a rotor covered by this warranty, Thermo Fisher Scientific will supply, free of charge (i) all centrifuge parts required for repair and (ii) if the centrifuge is currently covered by a Thermo Fisher Scientific warranty or service agreement, all labor necessary for repair of the centrifuge.

The foregoing obligations are in lieu of all other obligations and liabilities including negligence and all warranties, of merchantability or otherwise, expressed or implied in fact or by law, and state our entire and exclusive liability and buyer's exclusive remedy for any claim or damages in connection with the sale or furnishing of goods or parts, their design, suitability for use, installation or operation. Thermo Fisher Scientific will in no event be liable for any special or consequential damages whatsoever, and our liability under no circumstances will exceed the contract price for the goods for which liability is claimed.

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

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