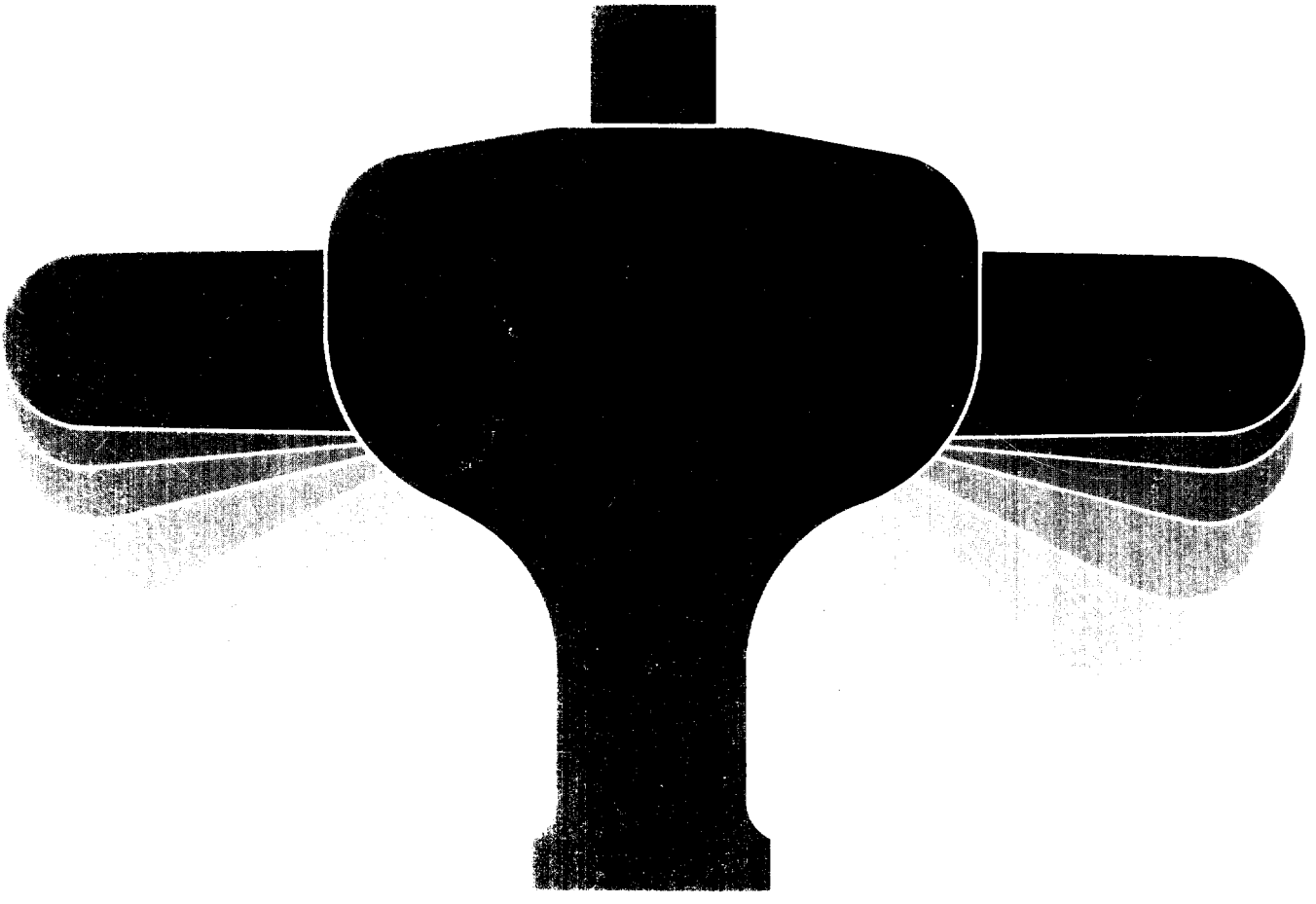
H-1000B

Rotor Manual



Sorvall Centrifuges

PN 11708-2

Medical Products

DUPONT

INSTRUCTION MANUAL

SORVALL® H-1000B HORIZONTAL ROTOR

Du Pont Company
Medical Products
Sorvall® Instruments
Wilmington, Delaware 19898
U.S.A.

Sorvall® Centrifuges

PN 11708-2
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This manual is a guide for the use of the

Sorvall® H-1000B Horizontal Rotor

Data herein has been verified and validated and is believed adequate for the intended use of the rotor. If the rotor or procedures are used for purposes over and above the capabilities specified herein, confirmation of their validity and suitability should be obtained, otherwise, DuPont does not guarantee results and assumes no obligation or liability. 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 A 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 A Caution informs the operator of an unsafe practice that could result in damage of equipment.

NOTE A Note highlights essential information.

WARNING

Regarding the Use of Hazardous Material

If using radioactive, toxic or pathogenic material, be aware of all characteristics of the material and the hazards associated with it should leakage occur during centrifugation. If leakage does occur, neither the centrifuge nor the rotor can protect you from the particles dispersed into the air. To protect yourself, we recommend additional precautions be taken to prevent exposure to these materials, for example, controlled ventilation or isolation. DO NOT USE MATERIALS CAPABLE OF PRODUCING FLAMMABLE OR EXPLOSIVE VAPORS.

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Warranty

Each Sorvall® H-1000B Rotor is warranted (subject to the conditions specified below and in the warranty clause of the DuPont terms and conditions of sale in effect at the time of sale) against defects in materials or workmanship for seven (7) years at any speed up to 3600 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 DuPont or by any authorized DuPont representative.

b. This warranty extends only to the original buyer and may not be assigned or extended to a third person without written consent of DuPont.

c. This warranty covers the rotor and its buckets only and DuPont shall not be liable for damage to accessories or ancillary supplies including but not limited to (i) tubes, (ii) tube caps, (iii) tube adapters, or (iv) tube contents.

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

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

THE FOREGOING OBLIGATIONS ARE IN LIEU OF ALL OTHER OBLIGATIONS AND LIABILITIES INCLUDING NEGLIGENCE AND ALL WARRANTIES, OF MERCHANTABILITY OR OTHERWISE, EXPRESSED OR IMPLIED IN FACT OR BY LAW AND STATE OUR ENTIRE AND EXCLUSIVE LIABILITY AND BUYER'S EXCLUSIVE REMEDY FOR ANY CLAIM OR DAMAGES IN CONNECTION WITH THE SALE OR FURNISHING OF GOODS OR PARTS, THEIR DESIGN, SUITABILITY FOR USE, INSTALLATION OR OPERATION. DUPONT 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.

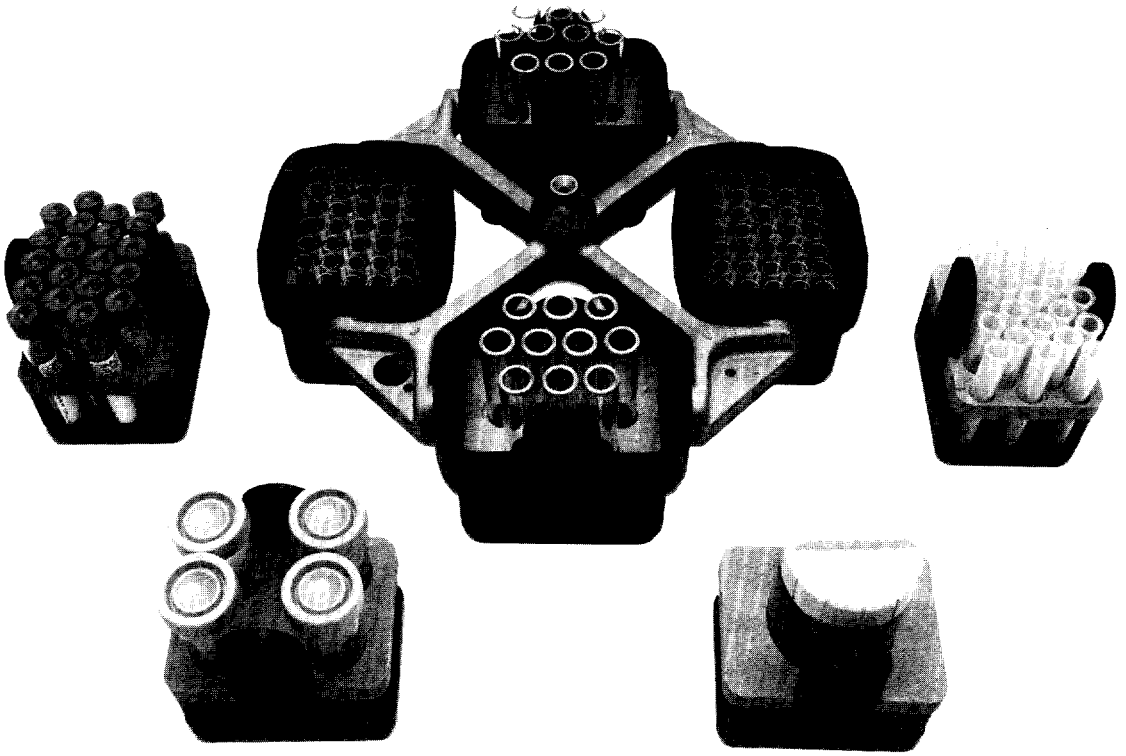

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Figure 1-1. Sorvall® H-1000B Horizontal Rotor

Section 1. DESCRIPTION

This manual provides you with the information you will need to operate and maintain your Sorvall® H-1000B Horizontal Rotor. If you encounter any problem concerning either operation or maintenance that is not covered in this manual, please contact the nearest district office or local representative of DuPont's Medical Products Department, SORVALL Instruments listed on the back of this manual.

1-1. Rotor Description

The H-1000B Rotor is designed for use in SORVALL RT6000(B), T6000(B) and GLC-4 Centrifuges. The rotor assembly is composed of a stainless steel rotor body and four aluminum buckets which hang from the rotor body on support pins. The buckets accept a variety of adapters made of glass-filled nylon. The adapters accept glass* or plastic tubes or bottles up to 70 mm in diameter. Optional clear plastic bucket covers are available for use with this rotor.

1-2. Rotor Specifications

- Maximum Speed** . . . . . 3600 rpm
- Maximum Speed with temperature control to 4°C . . . . . 3200 rpm
- Diameter . . . . . 38.6 cm (15.2 in)
- Radii (r):
  - $r_{maximum}$ . . . . . 19.15 cm (7.54 in)
  - r_{C_L} (center line) . . . . . 18.67 cm (7.35 in)
- Maximum Relative Centrifugal Force (RCF):
  - at $r_{maximum}$ 2770
  - at r_{C_L} 2702
- Number of Buckets. 4
- Total Rotor Mass (weight) includes rotor and 4 empty buckets . . . . . 4.7 kg (10.4 lb)
- Maximum Mass per Bucket (includes adapter and filled tubes or bottles). . . . . 650 g at 3600 rpm
- Maximum Tube Length . . . . . 15.4 cm (6.07 in) at center of adapter
- Critical Speed. . . . . 600 rpm in RT6000(B) and T6000(B) Centrifuges
  500 rpm in a GLC-4 Centrifuge

*IMPORTANT: Read paragraph 2-7 before using glass tubes with this rotor.

**Rotor 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 rotor speed will be designated as rpm.

1-3. Accessories

a. Adapters

The H-1000B Rotor buckets accept a variety of Sorvall® adapters. As shown in figure 1-2, each adapter is composed of two pieces, a base and a top. The two pieces may be disassembled for cleaning by sliding the top up and off the base. All bases are black, while each top is a different color. The color code identifies the size (by diameter) of the tubes that fit each adapter. Matching tops and bases are imprinted with the catalog number on the top and, with one exception, have corresponding hole patterns in the bottom. The one exception is the 14-mm Bio-Vial* adapter, which has a flat base and accepts only 14 mm x 57 mm closed, flat-bottomed tubes. All other adapters accept both round-bottomed and conical tubes.

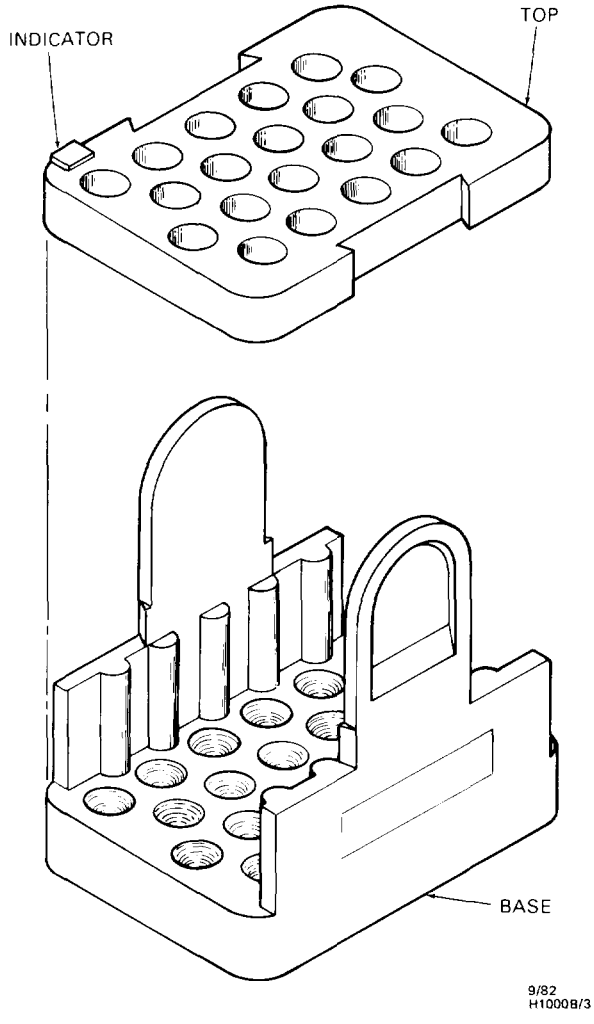


Figure 1-2. H-1000B Adapter Assembly

Whenever possible, tube receptacles in the adapter are patterned in groups of five. This aids in identifying a particular tube in the adapter. In addition, each receptacle is identified by a raised number on the surface of the adapter top. A raised indicator on the side of each adapter top identifies the location of the number one tube receptacle.

*Reg. U.S. Patent and Trademark Off. for Beckman's Containers.

For an up-to-date list and complete description of all tubes, bottles and adapters available for use with this rotor, please refer to the most current Sorvall® Rotors, Tubes, Bottles and Adapters Product Guide. To receive a copy, contact the nearest district office or local distributor for SORVALL Instruments listed on the back of this manual.

b. Other Accessories

Other accessories available for the H-1000B Rotor are listed in Table 1-1.

Table 1-1. Accessories

Description	Catalog Number
Rotor Buckets	11077 (set of 2)
Bucket Cover	11058 (each)
Rotor Extractor Tool	68078
Microplate Carrier	11065
50ml Sealed Bucket Assembly	11152 (each)

To order replacement parts or accessories, telephone (800) 551-2121 in the United States. Outside the United States contact your local representative for SORVALL Products. Be sure to provide a description of the part, catalog number, rotor type and serial number.

Section 2. OPERATION

2-1. Prerun Safety Checks

CAUTION

Failure to properly maintain your rotor can cause rotor failure with subsequent damage to your centrifuge. Also, depending on the sample being processed, rotor failure can result in biological or radioactive contamination. Therefore, every part of the rotor must be clean and should be carefully inspected before every run. If there is any sign of corrosion or cracking, the rotor should not be used.

To ensure safe performance of the rotor the following items should be checked before every run:

- make sure that the rotor body and the pins that mate with the buckets have no burrs, scratches, cracks or signs of corrosion;
- any combination of tubes and bottles must be wholly contained within the boundaries specified in figure 2-1 (see paragraph 2-2). If bucket covers are used, the tubes MUST NOT touch the inner surface of the covers;
- make sure that the centrifuge chamber and drive spindle are clean;
- gently move each bucket to ensure that they swing freely and are properly seated.

CAUTION

Before using tubes for the first time in this rotor, check them as follows:

Place empty tubes in the proper adapters, put the adapters in the buckets, and install the buckets in the rotor. Then, check that the buckets swing freely. If the tubes hit the rotor body, they are too long and should not be used.

CAUTION

The use of strong acids, bases, salts and salt solutions may cause a chemical reaction that will initiate corrosion if these materials come in contact with the aluminum buckets.

2-2. Tube Height Considerations

NOTE

The information in this paragraph applies to use of buckets without bucket cover assemblies. Safe clearance is ensured when bucket cover assemblies are used.

In swinging bucket rotors, the swing clearance of the bucket and its contents as they swing from the vertical to the horizontal position during centrifugation is very important--the proper clearance must be allowed to prevent the tubes (or bottles) from hitting the rotor body and breaking, resulting in loss of sample and possible damage to the rotor and the centrifuge.

Figure 2-1 should be used to make sure that the tubes or bottles (including covers) you intend to use with a particular adapter will allow for the proper clearance; this illustration indicates the maximum height of a tube or bottle that can safely be used in each hole of all adapters designed for use with this rotor.

2-3. 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 (i.e., 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 this rotor at the critical speed, which is 600 rpm in an RT6000(B) and T6000(B) and 500 rpm in a GLC-4.

CAUTION

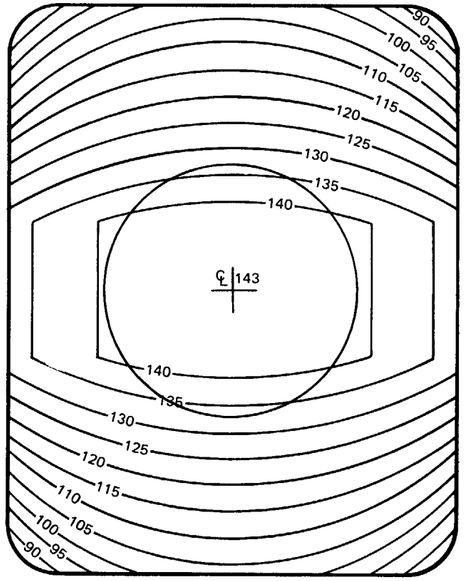
Continued operation at the critical speed will have a detrimental effect on centrifuge component life.

2-4. Relative Centrifugal Force (RCF) Determination

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

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

when r = the radius in centimeters
and n = the rotor speed in rpm.



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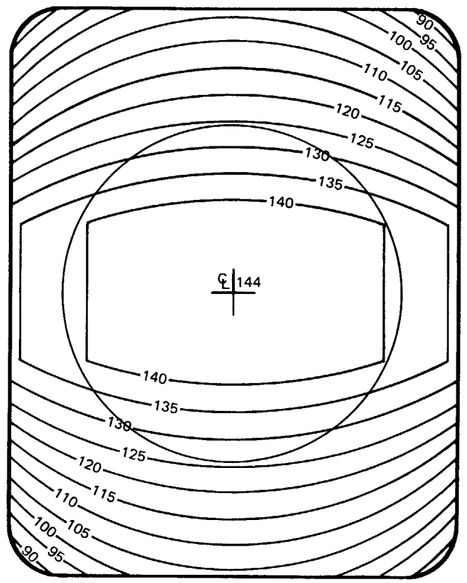

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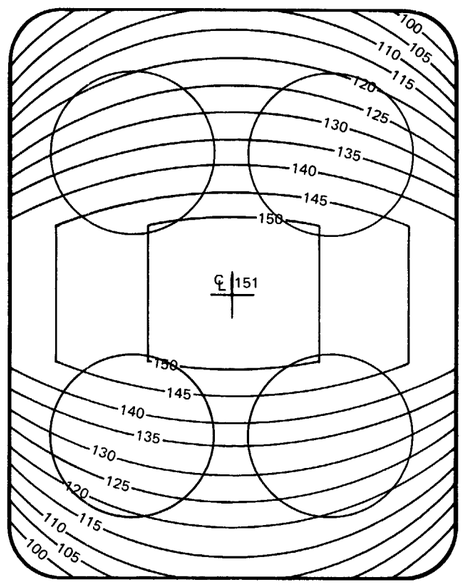

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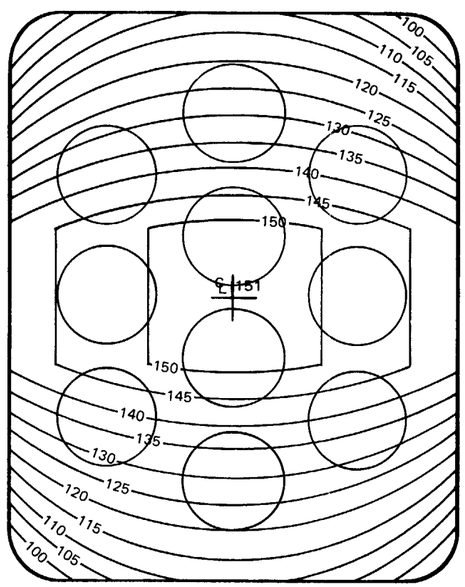

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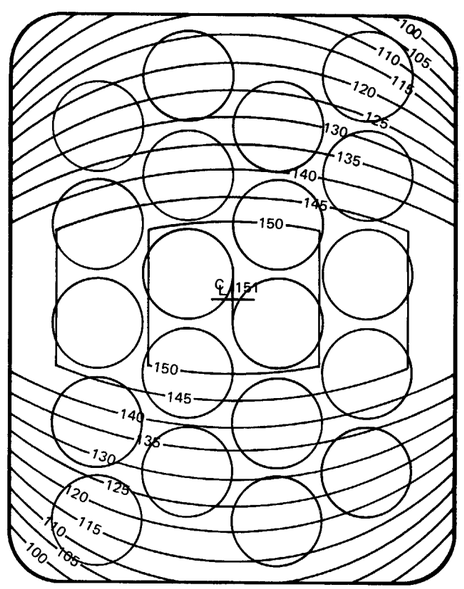

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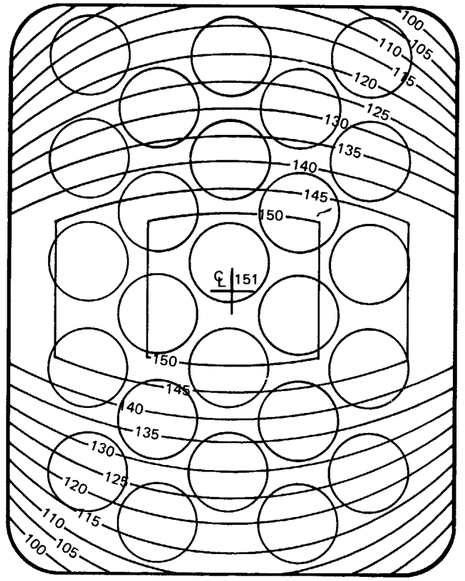

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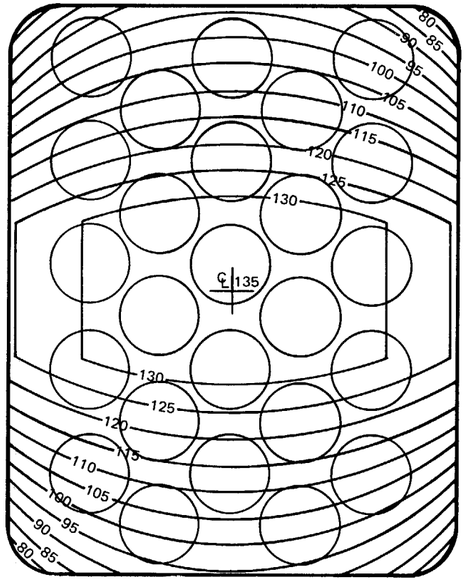

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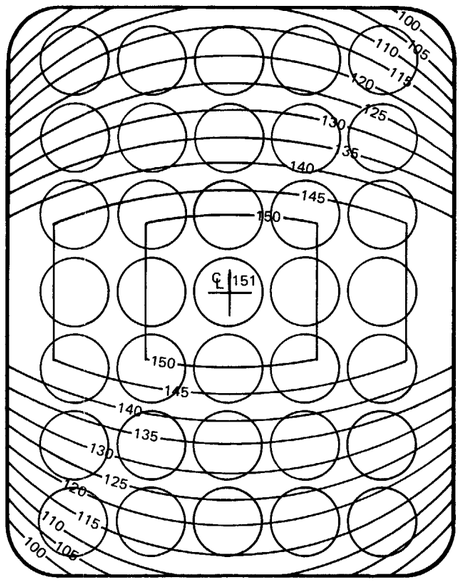

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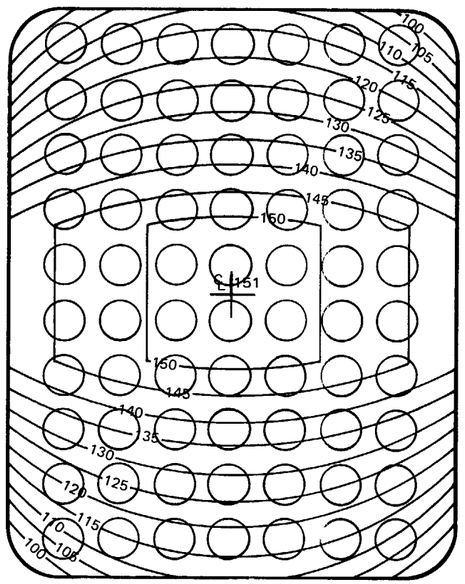

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NOTE

- The red circles represent the holes in the adapters.
- The black lines are used to determine the maximum height (in mm) of a tube or bottle (including any cap, plug, or sealing assembly) that can safely be used in each hole of each adapter. THESE LINES ARE APPROXIMATE AND SHOULD BE USED AS A GUIDE ONLY. After deciding which tubes to use, you should still check them before use as recommended in paragraph 2-1.
- If the tubes or bottles are being used with a cover (i.e., a cap, plug, or any other sealing assembly) be sure to consider both the diameter of the cover and the total height of the tube or bottle with the cover in place to determine if they can be used.

Figure 2-1. Maximum Tube Heights

Figure 2-2 shows tubes located at general points in a rotor bucket. In the H-1000B Rotor, the maximum RCF will be developed at the maximum rotational radius which occurs at the extreme outer edge of the bucket (^{r}maximum). The radius at the centerline of the bucket ($^{r}C_L$) is equal to 18.7 cm. Thus, the maximum RCF at $^{r}C_L$ is 2702.

The minimum RCF at the centerline can be determined by subtracting the height of the fill of the centermost tube from the $^{r}C_L$ (see figure 2-2). The minimum radius (^{r}minimum) can then be used to calculate RCF by using the formula given. For example, if the centermost tube is filled to a height of 109 mm (10.9 cm) from the bottom of the adapter, then:

$$^{r}\text{minimum} = {}^{r}C_L - \text{height of tube fill}$$
$$^{r}\text{minimum} = 18.7\text{ cm} - 10.9\text{ cm}$$
$$^{r}\text{minimum} = 7.8\text{ cm}$$

Using the value for ^{r}minimum and the value for the speed (hypothetically, 3600 rpm) at which the run will take place:

$$\text{RCF} = 11.17\ (7.8\text{ cm})\left(\frac{3600}{1000}\right)^2 = 1129$$

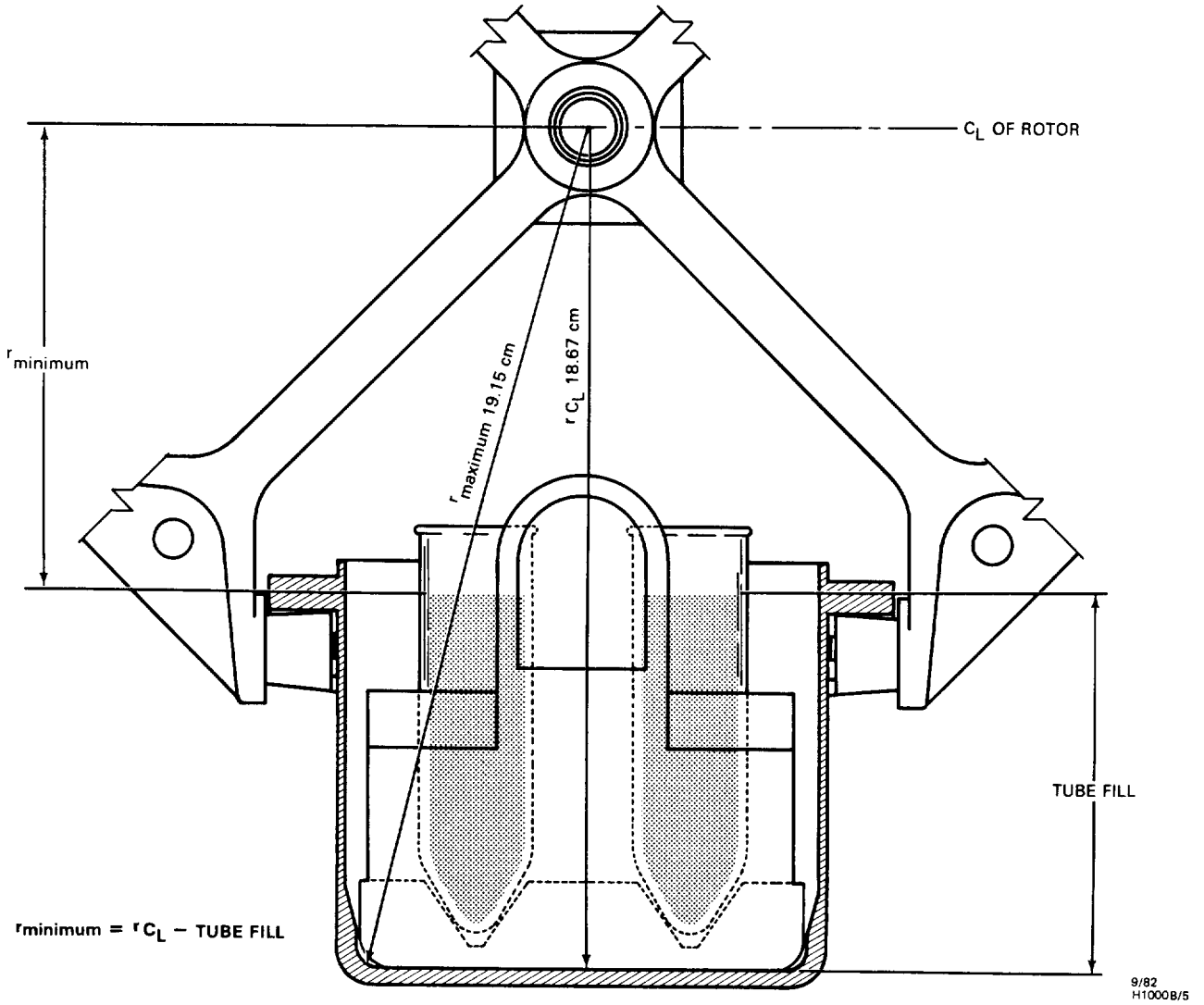


Figure 2-2. H-1000B Rotor Radii for RCF Determination

2-5. Compartment Loads in Excess of Design Mass

The maximum run speed (i.e., 3600 rpm) is based on the recommended design mass that has been established for the rotor, representing the maximum mass that each rotor compartment can contain at top-speed operation. The total contents for each bucket compartment including adapter, tubes and sample should not exceed the recommended figure unless the rotor speed is reduced proportionately.

CAUTION

Strict adherence to the maximum allowable compartment mass limitation specified is required for full speed operation. If the mass of the load in any compartment (i.e., bucket) exceeds this limit, the rotor speed must be reduced.

The design mass for each rotor compartment (i.e., adapter, tubes and sample) of the H-1000B Rotor is 650 grams at 3600 rpm. If the compartment mass is greater than 650 g, the maximum allowable speed can be determined by using the following formula:

$$\text{Reduced Speed} = 3600 \times \sqrt{\frac{650 \text{ grams}}{\text{Actual Compartment Mass (grams)}}}$$

Table 2-1 shows the maximum allowable compartment mass for the H-1000B Rotor at various speeds from 2980 rpm to 3600 rpm.

Table 2-1. Maximum Allowable Compartment Mass

Speed (rpm)	Maximum Compartment Mass (grams)
2980	950
3020	925
3060	900
3100	875
3150	850
3195	825
3245	800
3300	775
3350	750
3410	725
3470	700
3530	675
3600	650

2-6. Rotor Loading, Balancing and Installation

Each bucket of the H-1000B Rotor can contain a maximum mass of 650 grams, including the adapter, tubes, and sample. This figure must not be exceeded unless rotor speed is reduced as explained in paragraph 2-5.

Always load and balance the rotor according to the following criteria:

- the contents of each rotor bucket (including bucket cover, if used) must allow for the proper swing clearance (see paragraph 2-2).
- each bucket and its contents must be balanced with the opposing bucket to within 10 grams.
- each bucket must contain the same type of adapter and number of tubes as the opposing bucket.

WARNING

Each loaded bucket must contain an adapter that was designed for use with this rotor. Failure to load the bucket with the proper adapter can cause the adapter to fail during centrifugation, causing damage to the rotor and centrifuge which can result in possible injury. NEVER SPIN BLOOD BAGS IN THIS ROTOR.

To load and balance the buckets:

1. Load the adapters to be used with prepared tubes; pairs of adapters must be identically loaded.

CAUTION

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

2. Place each loaded adapter in a bucket.
3. Balance opposing buckets to within 10 grams. If necessary, add weight (in the form of fluid compatible with the sample) to the centermost tubes.
4. If bucket covers are used, secure them tightly onto opposing buckets. To ensure that the bucket covers fit properly, make sure the contents of the buckets do not touch the covers.

To install the rotor and buckets:

Before placing the rotor on the drive spindle, be sure that the rotor center hole and the drive spindle are clean and that they are not nicked or scratched. Wipe surfaces clean

before each use to lessen the chances of rotor sticking, scratching and corrosion.

1. Place the rotor body on the centrifuge drive spindle. The H-1000B fits directly on the drive spindle--the bore in the center hole of the rotor will guide it to the proper position on the spindle.

CAUTION

Install the rotor carefully. The centrifuge drive shaft bearings can be damaged if a rotor is dropped on the drive spindle.

2. Place each pair of balanced buckets in opposing rotor compartments (see figure 2-3). If only two buckets are loaded, place them in opposing compartments and place empty buckets in the remaining two compartments.

CAUTION

The H-1000B Rotor must always be run with a full complement of four buckets. If only two buckets are loaded, place them in opposing rotor compartments and place empty buckets in the remaining two compartments.

CAUTION

Before each run, gently move each bucket to ensure that it is properly seated and swings freely. Make this a routine check with each bucket before every run.

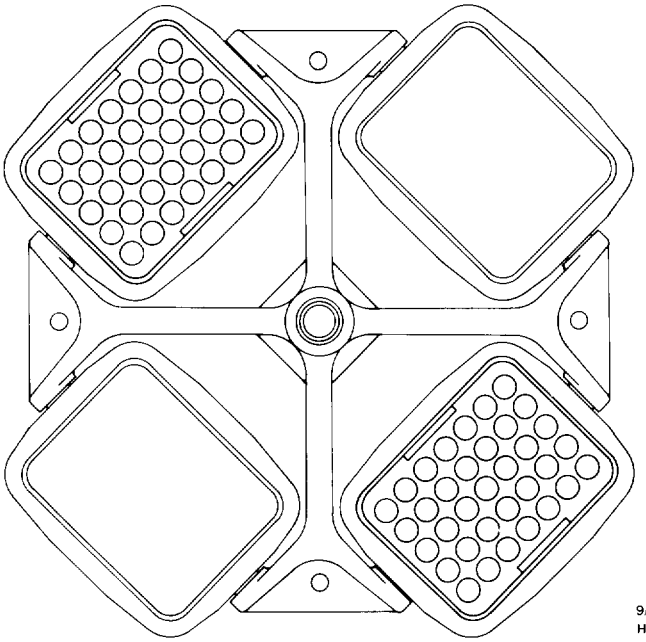
3. Close the centrifuge lid.

Perform the run according to the centrifuge instruction manual. At the end of the run, remove the rotor and buckets as follows:

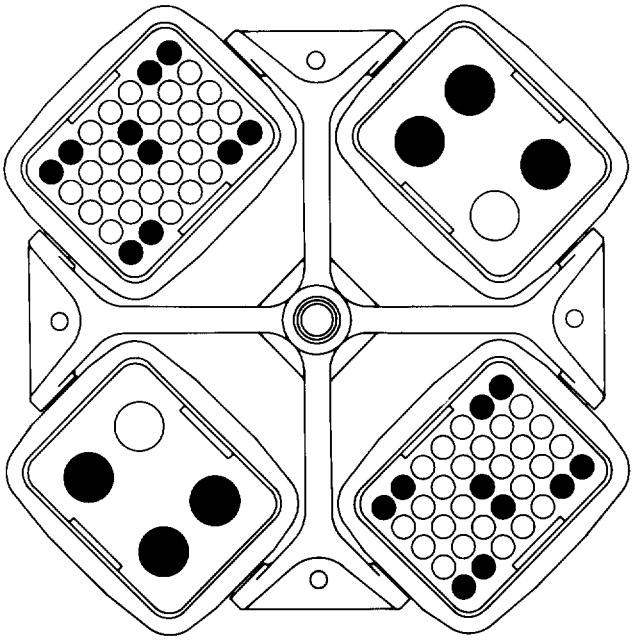
1. Open the centrifuge lid and remove the buckets. Remove bucket covers (if applicable) then remove adapters.

2. Remove the rotor from the drive spindle. If the rotor is stuck to the spindle, thread the rotor extractor tool (Cat. No. 68078) counterclockwise into the center hole of the rotor and pull the rotor from the spindle.

3. Clean and store rotor and rotor parts as described in Section 3.



When using two full buckets, they must be placed in opposing compartments, containing identical adapters, and balance within 10 grams. Empty buckets MUST be placed in the two remaining opposing compartments.



NOTE

This figure shows symmetrically loaded buckets with less than full loads. When using four buckets, opposing buckets must contain identical adapters and balance within 10 grams.

Figure 2-3. Sample Adapter Loading

2-7. Tube Breakage

There are many factors which influence the maximum speed at which glass or plastic tubes can be run without breakage. These factors include the dimension, tolerance and quality of the tubes themselves as well as their fill and support within the rotor.

CAUTION

Verify before operation that the tubes are being used with the proper adapter.

Tubes should be tested before use by running loaded with water to the required speed in the proper adapter. The opposing loads in the two carriers must be equal and balanced as described in paragraph 2-6.

WARNING

Never centrifuge disposable glass tubes more than once, and do not use them as balance tubes; balance tubes should be plastic. In addition, reduced rotor speeds may be necessary to prevent breakage of disposable glassware.

Even with pretesting, the possibility of tube breakage still exists because of the unobservable effect of repeated stress.

WARNING

If tubes break that contain hazardous materials, the entire rotor load and centrifuge should be considered contaminated and treated as such. The tubes, rotor, adapters, buckets, and centrifuge chamber should be decontaminated using appropriate decontamination procedure.

2-8. Chemical Compatibility

The critical components of the H-1000B that are apt to come in contact with solution are: rotor body (stainless steel), rotor buckets (aluminum), adapters (nylon), plus the material of the tubes being used.

The chemical compatibility of rotor elements and accessory materials is given in Table 4-1 (Section 4). Because no organized chemical resistance data exists for materials under the stress of centrifugation, this data is intented 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.

Section 3.
CARE and MAINTENANCE

3-1. Corrosion

The H-1000B rotor body is made of stainless steel, making it more resistant to corrosion than the aluminum alloy used in the buckets; however, it should be maintained and kept clean in the same manner. Proper care will lessen the chances of rotor failure and significantly prolong the useful life of the rotor and buckets.

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

Stress corrosion is thought to be initiated by certain combinations of stress and chemical reaction. The most common chemical causing harmful effects is chloride, whether in a solution such as ammonium salts or as subtle a form as hand perspiration. If the rotor and/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 the rotor is thoroughly washed and dried after use.

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

3-2. Cleaning

WARNING

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.

The H-1000B rotor body, buckets, bucket covers and adapters should be cleaned regularly with warm water and a mild, non-alkaline detergent. The adapters may be disassembled for cleaning by sliding the top up and off the base.

WARNING

Be certain that the pins on the rotor as well as the bucket surfaces that mate with the pins are clean before each use.

If sterilization is required, the rotor body and adapters can be autoclaved.

CAUTION

DO NOT autoclave the aluminum buckets. If the buckets are subjected to temperatures above 100°C, do not use. Use ethylene oxide or other appropriate procedure if sterilization is required.

3-3. Contamination

WARNING

Because of the characteristics of the samples likely to be processed in this rotor, biological or radioactive contamination may occur. Always be aware of this possibility and take 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 DuPont personnel, either at the customer's laboratory or at a DuPont facility, comply with the following procedure to ensure the safety of all personnel:

- Clean the centrifuge and/or rotor to be serviced of all encrusted material and decontaminate it prior to servicing by the DuPont representative. There must be no radioactivity detectable by survey equipment. Do not use highly alkaline decontamination solutions on the rotor body or buckets.

- Complete and attach Decontamination Information Certificate (Sorvall® Instruments Form No. IPDP-59) to the centrifuge or rotor.

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

Section 4. APPENDIX

Table 4-1. Chemical Compatibility Chart

Reagent	Polyallomer	Polypropylene	Polyethylene	Polycarbonate	Cellulose Acetate Butyrate	Nylon	Titanium	Delrin	Velox	Viton A	Buna N	Aluminum	Stainless Steel	Polysulfone
Acetaldehyde (100%)	M	M	M	U	U	—	S	—	—	U	U	S	—	—
Acetic Acid (5%)	S	S[1]	S	S	S	S	S	M	S	M	M	S	S	S
Acetic Acid (60%)	S	S[1]	S	U	U	M	S	U	S	U	U	S	S	S
Acetic Acid (Glacial)	S	S[1]	S	U	U	—	S	U	S	U	U	S	S	M
Acetone	S	S	S	U	U	U	S	M	M	U	U	S	S	U
Allyl Alcohol	—	S	S	S	U	U	S	S	S	—	—	—	—	—
Ammonium Acetate	S	S	S	S	—	—	S	—	—	—	—	—	—	—
Ammonium Carbonate	S	S	S	U	S	S	S	—	S	—	U	S	S	—
Ammonium Hydroxide (10%)	S[1]	S[1]	S	U	U	S	S	—	S	S	S	—	S	—
Ammonium Hydroxide (Conc.)	S[1]	S[1]	S	U	U	S	S	—	U	U	U	—	S	—
Ammonium Sulfate	S	S	S	S	—	S	S	U	—	—	S	S	S	—
Amyl Alcohol	S	S	S	S	U	S	S	S	S	M	M	S	—	—
Aqua Regia	U	U	U	U	U	—	S	U	M	M	U	U	—	—
Benzene	U	U	U	U	S+	S	S	M	M	S	U	S	S	U
Benzyl Alcohol	U	U	U	U	U	U	S	M	—	S	U	S	—	—
N-Butyl Alcohol	—	S	S	M	U	U	S	S	S	S	S	S	—	M
Calcium Chloride	S	S[1]	—	M	S	S	S	S	S	S	S	M	S	S
Calcium Hypochlorite	S	S	S	M	—	S	S	M	S	S	U	M	U	S
Carbon Tetrachloride	U	U	U	U	S	S	S	M	S	S	U	M	M	S
Chloroform	U	U	U	U	M	U	S	M	S	S	U	—	S	U
Chromic Acid (10%)	S	S	S	M	U	—	S	U	M	S	U	M	U	U
Chromic Acid (50%)	S[1]	S	S	U	U	—	S	U	M	S	U	U	U	U
Citric Acid (10%)	S	S	S	S	S	M	S	M	S	S	S	S	S	S
Diethyl Ketone	U	M	M	U	U	U	S	M	M	—	—	—	—	—
Dioxane	—	M	M	U	U	—	S	M	—	U	U	—	—	—
Distilled Water	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Ethyl Acetate	S	U	S	U	U	U	S	M	M	U	U	M	—	U
Ethyl Alcohol (50%)	S	S	S	S	S	U	S	M	S	S	S	S	S	S
Ethyl Alcohol (95%)	S	S	S	M	U	U	S	M	S	S	S	S	S	S
Ethylene Dichloride	U	U	U	U	U	—	S	S	M	S	U	—	—	—
Ethylene Glycol	S	S	S	S	S	U	S	S	S	S	S	S	—	S
Ferric Chloride	S	S	S	—	—	S	S	M	S	S	S	U	U	—
Formaldehyde (40%)	S	S[1]	S	S	—	S	S	—	M	S	M	M	S	S
Formic Acid (100%)	S	S	S	M	U	U	S	U	S	U	M	S	U	—
Hydrochloric Acid (10%)	S	S	S	S	S	S	S	U	S	S	U	U	U	S
Hydrochloric Acid (50%)	S	S	S	U	U	—	S	U	S	M	U	U	U	—
Hydrochloric Acid (Conc.)	S	S	—	U	U	—	S	U	S	—	U	U	U	—
Hydrofluoric Acid (10%)	S	S	S	M	M	S	U	U	S	—	U	U	U	S
Hydrofluoric Acid (50%)	—	S	S	U	U	—	U	U	U	M	U	U	U	M

KEY:

S = Satisfactory
S+ = If pure
S[1] = Discolored

M = Moderate attack, may be satisfactory for use in a 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 a sample to avoid loss of valuable material.

NOTE:

Chemical resistance data are included only as a guide (or starting point) to the selection of materials. Because no organized chemical resistance data exists for materials under the stress of centrifugation, when in doubt, we recommend pretesting of sample lots.

Continued

Table 4-1. Chemical Compatibility Chart (continued)

Reagent	Polyallomer	Polypropylene	Polyethylene	Polycarbonate	Cellulose Acetate Butyrate	Nylon	Titanium	Delrin	Velox	Viton A	Buna N	Aluminum	Stainless Steel	Polysulfone
Hydrogen Peroxide (3%)	S	S[1]	S	S	S	S	S	S	S	S	M	S	S	S
Hydrogen Peroxide (100%)	S	S[1]	S	S	S	—	U	U	M	M	U	S	S	S
Isobutyl Alcohol	—	S	S	S	U	U	S	S	S	S	M	—	—	—
Isopropyl Alcohol	S	S	S	S	U	U	U	S	S	S	M	U	—	M
Lactic Acid (20%)	S	S	S	S	—	—	S	—	S	S	S	—	S	S
Lactic Acid (100%)	S	S	S	S	—	—	S	—	S	S	S	—	S	—
Methyl Alcohol (100%)	S	S[1]	S	M	U	U	S	M	S	U	S	S	S	S
Methyl Ethyl Ketone	—	S	S	U	U	U	S	M	M	U	U	S	—	U
Methylene Chloride	U	U	M	U	U	U	S	S	U	M	U	S	S	U
Nickel Salts	S	S	S	S	S	S	S	—	S	S	S	M	S	—
Nitric Acid (10%)	S[1]	S	S	S	S	M	S	U	S	S	U	M	S[1]	S
Nitric Acid (50%)	S[1]	M	M	M	M	M	S	U	M	S	U	M	S[1]	—
Nitric Acid (95%)	M	M	U	U	U	U	S	U	U	S	U	M	S	U
Oleic Acid	S	S	S	S	S	S	S	S	S	M	U	S	S	S
Oxalic Acid	S	S	S	S	S	S	M	—	S	S	M	M	S	S
Perchloric Acid (10%)	S	S	M	U	—	—	S	U	S	S	—	U	—	—
Phenol (5%)	S	S	—	U	—	U	U	U	U	S	U	S	S	U
Phosphoric Acid (10%)	S	S	S	S	S	—	—	U	S	S	M	—	S	S
Phosphoric Acid (Conc.)	S	S	S	U	M	—	M	U	U	S	U	—	S	S
Potassium Hydroxide (5%)	S	S	S	U	S	S	M	U	S	S	M	U	S	S
Potassium Hydroxide (Conc.)	S	S	S	U	U	—	U	U	U	M	M	U	S	—
Sodium Carbonate (2%)	S	S[1]	S	S	S	S	S	S	S	S	S	M	S	—
Sodium Chloride (10%)	S	S	S	S	S	S	M	S	S	S	S	S	S	S
Sodium Chloride ("Sat'd.")	S	S	S	—	—	S	S	S	S	S	S	S	S	—
Sodium Hydroxide (> 1%)	S	S	S	U	S	S	S	U	S	S	M	U	S	S
Sodium Hydroxide (10%)	S	S	S	U	U	S	S	U	S	S	M	U	S	S
Sodium Hydroxide (Conc.)	S	S	S	U	U	—	S	U	U	U	M	U	S	—
Sodium Hypochlorite (5%)	S[1]	S	S	S	S	S	S	U	S	S	M	M	S	S
Sodium Sulfide	S	S	—	—	S	S	M	—	S	S	S	S	S	—
Sulfuric Acid (10%)	S	S	S	S	S	S	S	U	S	S	U	M	U	S
Sulfuric Acid (50%)	S	S	S	S	U	U	S	U	M	S	U	—	U	S
Sulfuric Acid (Conc.)	S[1]	S[1]	M	U	U	U	U	U	U	S	U	—	S	U
Toluene	U	U	U	U	S+	U	U	M	S	M	U	S	—	U
Trichlorethylene	U	U	U	U	—	U	U	—	M	S	U	—	—	U
Trichloroethane	—	U	U	U	—	—	S	M	S	S	U	—	—	M
Trisodium Phosphate	S	S	S	—	S	S	S	M	—	S	—	—	—	—
Urea	S	S	S	—	S	S	S	S	—	—	—	S	—	—
Urine	S	S	S	S	S	S	S	S	—	—	—	—	—	—
Xylene	U	U	U	U	S+	U	S	M	M	S	U	S	—	U
Zinc Chloride	S	S	S	S	S	S	S	—	S	S	S	M	M	S

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NOTE:

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IPDP-496F

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NOTES

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PART _____ PART NUMBER _____

CONTAMINATE USED _____

DECONTAMINATION CERTIFIED BY _____

DATE DECONTAMINATED _____

INSTRUCTIONS

When an instrument that has been used with radioactive or pathogenic material requires servicing by Du Pont personnel either at the customer's laboratory or at Du Pont facilities, the following procedure must be complied with to insure safety of our personnel:

1. The instrument or part to be serviced shall be cleaned of all blood and other encrusted material and decontaminated prior to servicing by our representative. No radioactivity shall be detectable by survey equipment.
2. A Decontamination Information Certificate (Sorvall Instruments Form No. IPDP-59) shall be completed and attached to the instrument or part.

If an instrument or part to be serviced does not have a Decontamination Information Certificate attached to it, and, in our opinion, the instrument or part presents a potential radioactive or biological hazard, our representative will not service the equipment until proper decontamination and certification has been completed. If an instrument is received at our Service facilities and, in our 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 Operation Instructions. Additional certificates are available from your local technical or customer service representative. In the event these certificates are not available, a written statement certifying that the instrument or part has been properly decontaminated and outlining the procedures used will be acceptable.

NOTE

Service representatives will indicate on a Customer Service Repair Report if decontamination was required, and if so, what the contaminate was and what procedure was used. If no decontamination was required, it should be so stated.

INSTRUCTIONS

When an instrument that has been used with radioactive or pathogenic material requires servicing by Du Pont personnel either at the customer's laboratory or at Du Pont facilities, the following procedure must be complied with to insure safety of our personnel:

1. The instrument or part to be serviced shall be cleaned of all blood and other encrusted material and decontaminated prior to servicing by our representative. No radioactivity shall be detectable by survey equipment.
2. A Decontamination Information Certificate (Sorvall Instruments Form No. IPDP-59) shall be completed and attached to the instrument or part.

If an instrument or part to be serviced does not have a Decontamination Information Certificate attached to it, and, in our opinion, the instrument or part presents a potential radioactive or biological hazard, our representative will not service the equipment until proper decontamination and certification has been completed. If an instrument is received at our Service facilities and, in our 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 Operation Instructions. Additional certificates are available from your local technical or customer service representative. In the event these certificates are not available, a written statement certifying that the instrument or part has been properly decontaminated and outlining the procedures used will be acceptable.

NOTE

Service representatives will indicate on a Customer Service Repair Report if decontamination was required, and if so, what the contaminate was and what procedure was used. If no decontamination was required, it should be so stated.

INSTRUCTIONS

When an instrument that has been used with radioactive or pathogenic material requires servicing by Du Pont personnel either at the customer's laboratory or at Du Pont facilities, the following procedure must be complied with to insure safety of our personnel:

1. The instrument or part to be serviced shall be cleaned of all blood and other encrusted material and decontaminated prior to servicing by our representative. No radioactivity shall be detectable by survey equipment.
2. A Decontamination Information Certificate (Sorvall Instruments Form No. IPDP-59) shall be completed and attached to the instrument or part.

If an instrument or part to be serviced does not have a Decontamination Information Certificate attached to it, and, in our opinion, the instrument or part presents a potential radioactive or biological hazard, our representative will not service the equipment until proper decontamination and certification has been completed. If an instrument is received at our Service facilities and, in our 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.

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